SPECIFICATIONS

The Board of Education for SSSD and VTSD of the County of Salem
880 Route 45
Woodstown, New Jersey 08098

Salem County Career and Technical High School
2024 Addition and Renovations
880 Route 45
Woodstown, New Jersey 08098

Architect:
Garrison Architects
713 Creek Road
Bellmawr, NJ 08031
(856) 396-6200
Fx (856) 396-6205

Construction Manager:
TBD

Site Engineer:
ARH Associates
215 Bellevue Avenue
Hammonton, NJ 08037
(609) 561-0482

Structural Engineer:
Orndorf and Associates
8600 West Chester Pike Suite 201
Upper Darby, PA 19082
(610) 896-4500

Mechanical, Electrical & Plumbing Engineer:
Mulhern Consulting Engineers
321 South York Road
Hatboro, PA 19040
(215) 293-9900

ISSUED FOR BID: November 3. 2023
GA# 21-125

INDEX TO THE SPECIFICATIONS

BIDDER'S CHECKLIST

☐ Bidder's Checklist (This Form) – Please include this form in the bid submission with each item included in the bid submission checked off within the circle for that item.

FAILURE TO SUBMIT THE FOLLOWING FORMS WITH THE BID SHALL BE CAUSE FOR AUTOMATIC REJECTION

☐ Bid Form which includes the Subcontractor Disclosure

☐ Acknowledgment of Receipt of Addenda / Clarifications. If no Addenda / Clarifications are issued, form shall still be submitted, with the applicable box checked on the form

☐ Statement of Ownership

☐ Bid Bond

☐ Consent of Surety

☐ Total Amount of Uncompleted Contracts Affidavit (Form DPMC 701)

☐ No Material Adverse Change in Qualification

THE FOLLOWING FORMS ARE REQUESTED TO BE SUBMITTED WITH THE BID

☐ Notice of Classification issued by the State of New Jersey Department of the Treasury Division of Property Management and Construction

☐ Hold Harmless Agreement

☐ Certification Regarding the Debarment, Suspension, Ineligibility and Voluntary Exclusion

☐ Federal Non-Debarment Government Certification

☐ Affirmative Action Requirements

☐ Exhibit B Mandatory Equal Employment Opportunity Language

☐ Non-Collusion Affidavit

BIDDER'S CHECKLIST

☐ C.271 Political Contribution Disclosure Form

☐ Prohibited Russia-Belarus Activities and Iran Investment Activities

☐ Equipment Certification

☐ Public Works Contractor Registration Certificate

☐ Business Registration Certificate

☐ Trade License (if applicable)

THE FOLLOWING INFORMATION IS TO BE PROVIDED IN THE CASE OF ALL PRIME SUBCONTRACTORS (DEFINED AS THOSE SUBCONTRACTORS THAT WILL FURNISH LABOR OF THE VARIOUS TRADES GOVERNED BY N.J.S.A. 18A:18A-18(B): GENERAL CONSTRUCTION, STEEL, HVAC, PLUMBING, ELECTRIC). UNDERLINED ITEMS MUST BE SUBMITTED WITH THE BID. ALL OTHER ITEMS ARE REQUESTED TO BE SUBMITTED WITH THE BID BUT MUST BE PROVIDED PRIOR TO CONTRACT AWARD

☐ A valid and active DPMC Notice of Classification,

☐ A Total Amount of Uncompleted Contracts Affidavit (form DPMC 701)

☐ No Material Adverse Change in Qualification Form

☐ Trade License (if applicable)

☐ Business Registration Certificate

☐ Public Works Contractor Registration Certificate

TRADE	Prime Subcontractor Name (if self-performing please indicate)	DPMC Notice of Class	Uncompleted Contracts	No Material Change	Trade License	Bus. Reg.	Public Works Certificate
GENERAL					N/A		
STRUCTURAL					N/A		
HVAC							
PLUMBING							
ELECTRICAL							

NOTICE TO BIDDERS

Sealed bids will be received by the Board of Education of the Special Services School District and the Vocational Technical School District of the County of Salem in the Conference Room of the Administration Building located at 880 Route 45, Woodstown, New Jersey 08098 until 3:00 P.M. local time on **Tuesday, December 12, 2023,** and will be publicly opened and read immediately thereafter, at said place for **Salem County Career and Technical High School 2024 Addition and Renovations.**

It is expressly understood that the Bidder is responsible for getting the bid to the Business Administrator by the time and date set for the bid opening. Late bids will not be accepted. Bids shall be addressed to the Owner whose name appears in Paragraph 1a of the Instructions to Bidders; they shall be mailed or delivered to the address stated herein, enclosed in an opaque sealed envelope, clearly marked with the name of the Bidder and the name of the Project as described in this Notice to Bidders; and must be received by not later than the time designated in this Notice to Bidders. No responsibility will attach to Architect or Owner for premature opening of a bid which is not properly identified. Any bid received after 3:00 PM will be returned unopened. No bids shall be received after the time designated in the advertisement. The Owner assumes no responsibility for delays in the mail or delivery service causing the bid to be received later than the due date and time or at an address other than as set forth above.

The Bidders are requested to submit, in accordance with N.J.S.A. 18A:18A-18(b)(2), one Lump Sum Bid for all the work and materials. Bidders and/or their Prime Subcontractors must be pre-qualified by the New Jersey Department of Treasury, Division of Property Management and Construction (DPMC) in the following categories, pursuant to N.J.S.A. 18A:18A-26 et seq.: C008 – General Construction or C009 General Construction / Alterations and Additions; C029 – Structural Steel and Ornamental Iron; C032 – HVACR; C030 – Plumbing; and C047 – Electrical. The Bidder and named Prime Subcontractors, defined as those listed in N.J.S.A. 18A:18A-18, listed must be pre-qualified prior to the date that bids are received.

Electronic Copies of the Bid Documents may be obtained by contacting Garrison Architects via email at jminniti@garrisonarch.com. There is no charge for obtaining an electronic copy of the Bid Documents. It is the responsibility of the Bidder to print all required forms included in the bid package. The Board assumes no responsibility for any required forms a Bidder may fail to include.

Bids must be accompanied by a certified check, bank cashier's check, treasurer's check or Bid Bond in the form provided in the Contract Documents, with corporate surety satisfactory to the Owner, in an amount of 10% of the Base Bid (but in no case in excess of $20,000.00, pursuant to N.J.S.A. 18A:18A-24), naming as payee or obligee, as applicable, **The Board of Education of the Special Services School District and the Vocational Technical School District of the County of Salem,** to be retained and applied by the undersigned as provided in the Contract Documents in case the successful Bidder defaults in executing the Agreement or furnishing the bonds and insurance certificates as required by the Contract Documents.

Prospective Bidders are advised that this Project is one which will be subject to and will be governed by provisions of New Jersey law, including, but not limited to, those regarding (a) Prequalification of Bidders (N.J.S.A. 18A:18A-26 et seq.); (b) Prevailing Wage Rates (N.J.S.A. 34:11-56.25 et seq.); (c) Use of Domestic Materials, (N.J.S.A. 18A:18A-20) (d) Ownership Disclosure Certification, (N.J.S.A. 52:25-24.2); and (e) disclosure of investment activities in Iran, Russia, and Belarus (N.J.S.A. 18A:18A-49.4 et seq. & N.J.S.A. 52:32-55 et seq.).

The bid package will also include other documents that must be completed and returned with the bid. Failure to comply with Instructions to Bidders and to complete and submit all required and/or requested forms, may be cause for disqualification and rejection of the bid.

NOTICE TO BIDDERS

The Public Works Contractor Registration Act N.J.S.A. 34:11-56.48 et seq. requires that the Bidder and Named Prime Subcontractors must be registered at the time of Bid. The Owner is requesting that copies of the Certificates for Bidder and its Named Prime Subcontractors be included in the Bidder's Bid Package, but the Bidder must provide copies of the Certificates no later than the time of award. Pursuant to N.J.S.A. 52:32-44 all business organizations that do business with a local contracting agency, including Bidders and Named Prime Subcontractors, are required to be registered with the State through the New Jersey Department of Treasury, Division of Revenue. The Owner is requesting that copies of the Registrations for Bidder and its Named Prime Subcontractors be included in the Bidder's Bid Package, but the Bidder must provide proof of such Registrations prior to the award of the Contract. In addition, each bid must be accompanied by a certificate from a surety company stating it will provide said Bidder with a bond in such sum as required by the N.J.S.A. 18A:18A-25.

No bid may be withdrawn for a period of sixty (60) days after the dates set for the opening thereof. The right is reserved to reject all bids pursuant to N.J.S.A. 18A:18A-22 or to waive minor informalities, defects, and non-material exceptions in the best interests of the Board. Bidders are required to comply with the provisions of N.J.S.A. 10:5-31 et seq. and N.J.A.C. 17:27-1.1 et seq.

The Time Schedule for the project is as follows:

Friday	**11/03/23**	Bid packages available via Electronic Delivery
Wednesday	**11/08/23**	Pre-bid meeting at **1:00 P.M.** in the Conference Room of the Administration Building located at 880 Route 45, Woodstown, New Jersey 08098.Attendance at the Pre-Bid meeting is not mandatory, but strongly recommended.
Tuesday	**11/28/23**	Deadline for Questions at 5:00 P.M. (email to jminniti@garrisonarch.com)
Thursday	**11/30/23**	Deadline for Addendum Issued to Bidders, if necessary
Tuesday	**12/12/23**	Bids Due at **3:00 P.M.** at the Conference Room of the Administration Building located at 880 Route 45, Woodstown, New Jersey 08098.

By Order of the Board of Education of the Special Services School District and the Vocational Technical School District of the County of Salem
Jennifer K. Bates, Ed.D. Assistant Superintendent / Business Administrator

INSTRUCTIONS TO BIDDERS

(The following instructions shall be adhered to in the preparation of this bid by the bidder.)

1. DEFINITIONS

a. Owner: The term "Owner" as used in the Contract Documents refers to the Board of Education of the Special Services School District and the Vocational Technical School District of the County of Salem, 880 Route 45, Woodstown, New Jersey 08098.

b. Architect: The term "Architect" refers to Garrison Architects, 713 Creek Road, Bellmawr, New Jersey 08031, (856) 396-6200, Fax (856) 396-6205.

c. Construction Manager: The term "Construction Manager" refers to **TBD.**

d. Contractor: The term "Contractor" refers to the bidder to whom an award is made to perform the work under the Contract enumerated in the Notice to Bidders.

e. School Facilities Project: This is the construction project which is the subject of this specification.

f. The Contract Documents include: all items listed in the Index to the Specifications, including forms submitted by the awardee; all Addenda / Clarifications; all Drawings made available prior to the submission of bids; all Specifications made available prior to the submission of bids; all Schedules made available prior to the submission of bids; and the A101 and A201, both as modified by Owner, to be entered by the Owner and the awardee and all documents attached thereto and incorporated therein. In the event of any conflict or inconsistency between any of the Contract Documents, the interpretation most favorable to the Owner and/or which imposes upon Contractor a greater obligation, shall control.

2. PREPARATION OF BIDS

a. Bids shall be submitted on the Bid Form. All blank spaces of the form shall be fully completed in accordance with these instructions, without variation, and there shall be no interlineations, deletions or additions. Base Bid Sum shall include the allowance and shall be stated both in writing and in figures; and, in case of discrepancy, written words shall be considered as being the Base Bid Sum. Any bid price showing any erasure or alteration must be initialed by the Bidder in ink, at the right margin next to the altered entry. Failure to initial any erasure or alteration may be cause to disqualify that particular bid entry. If the disqualified entry is a required one, the entire bid may be subject to rejection. If an erasure or alternation results in any aspect being unclear, the Board shall be entitled to utilize the interpretation most favorable to the Board and imposing a greater obligation on Bidder. Submit the full bid package in duplicate (1 original and 1 copy).

b. Bids shall not contain recapitulations of the work to be done. No oral, telegraphic or telephonic communications or modifications shall be considered.

c. Bids shall be addressed to the Owner whose name appears in Paragraph 1a of the Instructions to Bidders; it shall be mailed or delivered to the address stated in the Notice to Bidders, enclosed in an opaque sealed envelope, marked with the name and number of the Project and bidder as described in the Notice to Bidders; and must be received by not later than the time designated in the Notice to Bidders. No responsibility will attach to Architect or Owner for premature opening of a bid which is not properly identified. The Owner assumes no responsibility for delays in the mail or delivery service causing the bid to be received later than the due date and time or at an address other than as set forth above.

d. Bidders shall submit all documents listed on the Bidder's Checklist. Failure to comply with Instructions to Bidders and to complete and submit all required forms, may be cause for disqualification and rejection of the bid.

e. The failure to include a document with a bid may not be considered a material defect where the Bidder's Checklist "requests", rather than requires, that the document be submitted with the bid. However, the failure to submit such document prior to award shall be cause for the Owner's refusal to award and for rejection of the bid.

3. DISCREPANCIES OR OMISSIONS: BIDDER'S RESPONSIBILITY

a. Bidders who find discrepancies in or omissions from the Contract Documents or are in doubt as to their meaning should at once notify the Architect immediately and in writing no later than the Deadline for Questions set forth in the "Notice to Bidders". If it is deemed necessary, instructions in the form of Addenda / Clarifications to Specifications and / or Drawings will be issued to all bidders by email on the date set forth in the "Notice to Bidders". Owner or Architect will not be responsible for any oral instructions. **It will be assumed with the submission of the bid that the bidder has fully examined and is sufficiently familiar with the site and the Contract Documents and has made provisions for construction under the applicable conditions; Bidder is responsible for seeing that his Prime Subcontractors are similarly familiar with the site and requirements of the Contract Documents so far as applicable to their work.**

b. Bids shall be based upon the Contract Documents and may not be withdrawn for a period of 60 days after the date set for receiving bids. Any bid which has been opened by the Owner may not be withdrawn during the period specified herein except as specifically permitted by law.

4. BID SECURITY: FORFEITURE

a. Bids shall be accompanied by a bid guarantee in the form of a Bid Bond issued by a Surety licensed in the State of New Jersey, cashier's check or a certified check issued by a national bank or trust company and payable to the order of the Owner in the amount of ten (10%) percent of the Bid or $20,000, whichever is less, pursuant to N.J.S.A. 18A:18A-24, to be retained and applied as provided, in case the bidder should default in executing the Agreement, or furnishing the required insurance certificates within ten (10) days after notice that an award has been made to it, or furnishing the required Performance and Payment Bond as required by the Contract Documents. The Surety shall be authorized to do business in New Jersey.

b. Bid securities of the three lowest responsible bidders will be retained until Contract Documents have been properly executed by the bidder to whom the contract is awarded but in no event exceeding 60 days after bid opening unless consent of the bidders and, if applicable, their sureties is obtained for such longer period as may be agreed. In the event that a Bid Bond is submitted with the bid, the bidder shall make certain that a proper power of attorney evidencing the authority of the agent of the surety to execute the Bid Bond is furnished therewith.

c. Bidders who intend to submit a Bid Bond as the required security with their bids must use the form of Bid Bond provided or its legal equivalent. Such bidders must also provide a Power of Attorney for the Attorney-In-Fact who issued the Bond, which document must be currently dated and valid for the entire amount of the Bond.

5. CONSENT OF SURETY

Pursuant to N.J.S.A. 18A:18A-25, bids shall be accompanied by a Consent of Surety assuring that satisfactory arrangements have been made between the Surety and the bidder, by which the Surety agrees to furnish the bidder with a Performance Bond, Payment Bond and Maintenance Bond, each in the stated amount of one hundred percent of the Contract amount. The Consent of Surety shall be executed by an approved Surety Company authorized to do business in the State of New Jersey. The Surety's consent and guarantee to issue the Performance Bond, Payment Bond, and Maintenance Bond must be unconditional. **Submission of a Consent of Surety which contains any prior conditions upon the Surety's issuance of the required Bonds shall be cause for rejection of the Bid.**

6. AWARD OF CONTRACT

a. The Owner reserves the right to waive minor informalities or non-material exceptions in the bid or bidding process, in accordance with applicable law and in the discretion of Owner. Bids may be rejected if they show any omissions, alterations of form, additions or deductions not called for, conditional or uninvited alternate bids, or irregularities of any kind. Bids in which the prices are unbalanced may be rejected. Claims on account of mistakes in or omissions in bids will not be considered, except as specifically permitted by law. The submission of a bid vests no contractual, property, or other right in favor of the bidder.

b. The Owner reserves the right to reject all bids pursuant to the Public Schools Contracts Laws. The Owner reserves the right to disqualify a bidder with whom the Owner, and/or any other school district in the State of New Jersey and/or the New Jersey Economic Development Authority or successor State Agency, had prior negative experience(s) as defined and in accordance with N.J.S.A. 18A:18A-4.

c. Before awarding a Contract, the Owner may require the apparent low bidder for the Contract to provide proof that the bidder possesses the necessary equipment that will be required to complete this project in accordance with N.J.S.A. 18A:18A-23.

d. The award of Contract or rejection of bids will be made within sixty (60) days of the Bid Opening, except that the bids of any bidders who consent thereto in writing may, at the request of the Owner, be held for consideration for such longer period as may be agreed.

e. If awards are made, the Owner and Contractor will execute the Agreement within twenty-one (21) days after the date of the award, Saturdays, Sundays and holidays excepted. This time may be extended by agreement of the Owner and the awardee.

f. The A101, A201, and Performance and Payment Bond and Maintenance Bond forms included with these Specifications exemplify the type of Contract forms that the successful bidder will be required to execute before or after award has been made, in accordance with the Contract Documents and State law governing such Bonds.

g. Change orders under the Contract are subject to N.J.A.C. 5:30-11 and the availability of funds per N.J.A.C. 6A:23A-21.1.

7. CHANGES PRIOR TO OPENING OF BIDS

a. During the period allowed for the preparation of bids, the Architect may furnish the prospective bidders Addenda / Clarifications setting forth additions to or alterations of the Contract Documents, which additions or alterations shall be included by each bidder in the computation of amounts to be inserted by it in the bid which it submits, and which Addenda / Clarifications shall become a part of such Contract Documents as if the same were fully incorporated herein.

b. It shall be the duty of each prospective bidder to inform its prospective Subcontractors of such Addenda / Clarifications to the extent that they may be affected.

c. Any Addenda / Clarifications issued by the Architect will be sent in a manner consistent with N.J.S.A. 18A:18A-21 to each prospective bidder of whom the Architect shall have a record.

8. START OF WORK

Shop Drawings, Submittals, etc. can be commenced after Notice to Proceed has been given by Owner or Architect.

9. COMPLETION OF THE PROJECT

The project must be completed by the date set forth in the Specification Section 01010- Summary of Work. In accordance with N.J.S.A. 18A:18A-19, the Owner may deduct, from the contract price, any wages paid by the Owner to any inspector or inspectors necessarily employed by it on the work, for any number of days in excess of the completion date.

10. BONDS AND INSURANCE

Requirements for Bonds and Insurance are stated in these Instructions to Bidders, Specifications and the A201. Performance and Payment Bonds are required in the amount of 100% of the Contract price for each Bond. A Two (2) year Maintenance Bond is required in the amount of 100% of the Contract.

Performance Bond and Payment Bond need not be submitted with the bidder's bid but must be submitted prior to the award of the contract. Performance Bond and Payment Bond shall be in compliance with requirements of the New Jersey Publics Schools Contracts Law and Public Works Bond Act, specifically N.J.S.A. 18A:18A-25 and N.J.S.A. 2A:44-143 et seq. The Maintenance Bond shall be in the form provided herewith and shall be provided to Owner as required in the A201.

11. STATEMENT OF BIDDER'S QUALIFICATIONS

In accordance with N.J.S.A. 18A:18A-26 et seq. each bidder shall submit the following documents for itself (and for each of its Prime Subcontractors) from the State of New Jersey's Department of the Treasury, Division of Property Management and Construction:

(1) A NOTICE OF CLASSIFICATION indicating that they are qualified to bid on the public work as specified herein. The bidder and/or named Prime Subcontractors must be pre-qualified by the New Jersey Department of Treasury, Division of Property Management and Construction, prior to the date that bids are received. This document is requested to be provided with the bid but shall be provided prior to award. The required categories are: C008 – General Construction or C009 General Construction / Alterations and Additions; C029 – Structural Steel and Ornamental Iron; C032 – HVACR; C030 – Plumbing; and C047 – Electrical;

(2) A TOTAL AMOUNT OF UNCOMPLETED CONTRACTS affidavit (Form DPMC 701) duly signed and notarized with the corporate seal affixed. This document must be submitted with the bid; and

(3) Affidavits of no material adverse change in qualification information since the latest statements in accordance with N.J.S.A. 18A:18A-32. These document must be submitted with the bid.

12. NEW JERSEY PREVAILING WAGE RATE / PUBLIC WORKS CONTRACTOR REGISTRATION

Bidders are required to comply with the New Jersey Prevailing Wage Act, N.J.S.A. 34:11-56.25 et seq. (the "Wage Act"), as amended.

Contractor shall ensure that all workers employed in the performance of this Contract shall be paid not less than the Prevailing Wage Rate designated for this locality by the Commission of Labor and Workforce Development. If it is found that any worker employed by the Contractor or any Subcontractor has been paid less than the Prevailing Wage Rate or otherwise violates the Wage Act, the Owner may terminate the Contractor's or Subcontractor's right to proceed with the work, or such part of the work as to which there has been a failure to pay required wages and to prosecute the work to completion or otherwise. The Contractor and its sureties shall be liable for any excess costs occasioned thereby to the Owner.

Pursuant to N.J.S.A. 34:11-56.27a, if the lowest responsive bidder submits a bid that is ten percent (10%) or more below than the next lowest bid, the lowest responsive bidder shall certify to the Owner that the prevailing wage rates required by the Wage Act shall be paid. If the bidder does not provide the certification prior to award of the contract, the bidder shall not be entitled to the award and its bid will be rejected.

The Contractors can reference the State of New Jersey Department of Labor and Workforce Development Website https://www.nj.gov/labor/wagehour/wagerate/CurrentWageRates.html to view current Prevailing Wage Rates. The official wage rates will be included in the contract by the Board.

The Public Works Contractor Registration Act, N.J.S.A. 34:11-56.48 et seq. (the "Registration Act") requires that Contractors and Prime Subcontractors must be registered pursuant to the Registration Act prior to submitting a bid. The Owner requests bidder provide a copy of the Public Works Contractor Registration Certificate for itself and any Prime Subcontractors at the time of submission of the bid, but bidder must provide the Public Works Contractor Registration Certificate for itself and any Prime Subcontractors prior to award. The Contractor shall enter into subcontracts only with subcontractors, whether Prime Subcontractors or otherwise, who are registered pursuant to the Act.

13. BUSINESS REGISTRATION AND USE TAX

Pursuant to N.J.S.A. 52:32-44, the Owner is prohibited from entering into a contract with a bidder unless the bidder and each Prime Subcontractor has a valid Business Registration Certificate on file with the Division of Revenue and Enterprise Services within the Department of the Treasury. The Owner is requesting that copies of the Registrations for bidders and their Prime Subcontractors be included with the bid, but the bidder must provide proof of such Registrations prior to the award.

Additionally:

(1) The contractor shall not enter a contract with a subcontractor, whether a Prime Subcontractor or otherwise, for this project unless the subcontractor first provides the contractor with a valid proof of business registration.

(2) After award, and prior to commencing work on site, the Contractor shall maintain and submit to the Owner a list of subcontractors and their addresses, which must be updated as provided information is no longer current.

(3) The contractor and any subcontractor providing goods or performing services for this project, and each of their affiliates, shall collect and remit to the Director of the Division of Taxation in the Department of the Treasury, the use tax due pursuant to the Sales and Use Tax Act, (N.J.S.A. 54:32B-1 et seq.) on all sales of tangible personal property delivered into the State. Any questions in this regard can be directed to the Division of Taxation at (609)292-6400. Form NJ-REG can be filed online at http://www.state.nj.us/treasury/revenue/busregcert.shtml.

Before final payment is made under the contract, the contractor shall submit to the Owner a complete and accurate final list of all subcontractors used and their addresses.

Pursuant to N.J.S.A. 54:49-4.1, a business organization that fails to provide a copy of a business registration as required, or that provides false business registration information, shall be liable for a penalty of $25 for each day of violation, not to exceed $50,000, for each proof of business registration not properly provided under a contract with a contracting agency.

14. OWNERSHIP DISCLOSURE CERTIFICATION

Pursuant to N.J.S.A. 52:25-24.2, no corporation, partnership, or limited liability company shall be awarded any contract nor shall any agreement be entered into for the performance of any work or the furnishing of any materials or supplies, the cost of which is to be paid with or out of any public funds, by the State, or any county, municipality or school district, or any subsidiary or agency of the State, or of any county, municipality or school district, or by any authority, board, or commission which exercises governmental functions, unless prior to the receipt of the bid or proposal, or accompanying the bid or proposal of said corporation, said partnership, or said limited liability company there is submitted a statement setting forth the names and addresses of all stockholders in the corporation who own ten percent (10%) or more of its stock, of any class, or of all individual partners in the partnership who own a ten percent (10%) or greater interest therein, or of all members in the limited liability company who own a ten percent (10%) or greater interest therein, as the case may be.

If one or more such stockholder or partner or member is itself a corporation or partnership or limited liability company, the stockholders holding ten percent (10%) or more of that corporation's stock, or the individual partners owning ten percent (10%) or greater interest in that partnership, or the members owning ten percent (10%) or greater interest in that limited liability company, as the case may be, shall also be listed. The disclosure shall be continued until the names and addresses of every non-corporate stockholder, and individual partner, and member, exceeding the ten percent (10%) ownership criteria established in this act, has been listed.

To comply with this section, a bidder with any direct or indirect parent entity which is publicly traded may submit the name and address of each publicly traded entity and the name and address of each person that holds a ten percent (10%) or greater beneficial interest in the publicly traded entity as of the last annual filing with the federal Securities and Exchange Commission or the foreign equivalent, and, if there is any person that holds a ten percent (10%) or greater beneficial interest, also shall submit links to the websites containing the last annual filings with the federal Securities and Exchange Commission or the foreign equivalent and the relevant page numbers of the filings that contain the information on each person that holds a 10 percent or greater beneficial interest.

The Ownership Disclosure Certification form shall be completed, signed, notarized, and submitted with the bid.

15. DISCLOSURE OF INVESTMENT ACTIVITIES IN IRAN, RUSSIA and BELARUS

The Owner, pursuant to N.J.S.A. 18A:18A-49.4 et seq., shall implement and comply with Disclosure of Investment Activities in Iran, Russia, and Belarus pursuant to N.J.S.A. 52:32-55 et seq.

Pursuant to N.J.S.A. 52:32-57 et seq. (P.L. 2012, c.25 and P.L. 2021, c.4 and P.L. 2022, c.3) any person or entity that submits a bid or proposal or otherwise proposes to enter into or renew a contract must certify, prior to the time a contract is awarded and at the time the contract is renewed, that neither the person nor entity, nor any of its parents, subsidiaries, or affiliates, is identified on the as a person or entity engaged in investment activities in Iran, Russia, or Belarus. The Iran list is found on the Division's website at https://www.state.nj.us/treasury/purchase/pdf/Chapter25List.pdf; the Russia and Belarus list is found on the Division's website at https://www.nj.gov/treasury/administration/pdf/RussiaBelarusEntityList.pdf. Vendors/bidders must review these lists prior to completing the below certification. If the Director of the Division of Purchase and Property finds a person or entity to be in violation of the law, the Director shall take action as may be appropriate and provided by law, rule or contract, including but not limited to, imposing sanctions, seeking compliance, recovering damages, declaring the party in default and seeking debarment or suspension of the party.

If the Board determines that a person or entity has submitted a false certification concerning its engagement in investment activities in Iran under N.J.S.A. 52:32-58 or Russia or Belarus under N.J.S.A. 52:32-60.1, the board shall report to the New Jersey Attorney General the name of that person or entity, and the Attorney General shall determine whether to bring a civil action against the person to collect the penalty prescribed in N.J.S.A. 52:32-59 and/or N.J.S.A. 52:32-60.1.

In addition, bidders must provide a detailed, accurate and precise description of the activities of the bidding person/entity, or any of its parents, subsidiaries or affiliates, engaging in the investment activities in Iran, Russia, and Belarus outlined above by completing the boxes on the lower portion of the enclosed form.

The Board has provided within the specifications, a Disclosure of Investments Activities certification form for all persons or entities, that plan to submit a bid, respond to a proposal, or renew a contract with the board, to complete, sign and submit prior to the award of the proposal.

The Disclosure of Investment Activities in Iran, Russia, and Belarus Form is to be completed, certified and submitted prior to the award of contract.

16. N.J.S.A. 10:5-31, et seq. AFFIRMATIVE ACTION

Pursuant to N.J.S.A. 10:5-31 et seq., as amended and supplemented, the following Affirmative Action requirements on the Project will be a condition of the Contract: The bidder, its subconsultants and subcontractors shall comply with the anti-discrimination provisions of N.J.S.A. 10:2-1 et seq., the New Jersey Law Against Discrimination, N.J.S.A. 10:5-1 et seq., N.J.A.C. 17:27-1.1 et seq. and shall guarantee to afford equal opportunity in performance of this Agreement in accordance with an affirmative action program approved by the State Treasurer.

17. N.J.S.A. 10:2-1. Anti-discrimination Provisions

Every contract for or on behalf of the State or any county or municipality or other political subdivision of the State, or any agency of or authority created by any of the foregoing, for the construction, alteration or repair of any public building or public work or for the acquisition of materials, equipment, supplies or services shall contain provisions by which the contractor agrees that:

a. In the hiring of persons for the performance of work under this contract or any subcontract hereunder, or for the procurement, manufacture, assembling or furnishing of any such materials, equipment, supplies or services to be acquired under this contract, no contractor, nor any person acting on behalf of such contractor or subcontractor, shall, by reason of race, creed, color, national origin, ancestry, marital status, gender identity or expression, affectional or sexual orientation or sex, discriminate against any person who is qualified and available to perform the work to which the employment relates;

b. No contractor, subcontractor, nor any person on his behalf shall, in any manner, discriminate against or intimidate any employee engaged in the performance of work under this contract or any subcontract hereunder, or engaged in the procurement, manufacture, assembling or furnishing of any such materials, equipment, supplies or services to be acquired under such contract, on account of race, creed, color, national origin, ancestry, marital status, gender identity or expression, affectional or sexual orientation or sex;

c. There may be deducted from the amount payable to the contractor by the contracting public agency, under this contract, a penalty of $ 50.00 for each person for each calendar day during which such person is discriminated against or intimidated in violation of the provisions of the contract; and

d. This contract may be canceled or terminated by the contracting public agency, and all money due or to become due hereunder may be forfeited, for any violation of this section of the contract occurring after notice to the contractor from the contracting public agency of any prior violation of this section of the contract.

No provision in this section shall be construed to prevent a board of education from designating that a contract, subcontract or other means of procurement of goods, services, equipment or construction shall be awarded to a small business enterprise, minority business enterprise or a women's business enterprise pursuant to 18A:18A-51 et seq. (P.L.1985, c.490, as amended).

18. DOMESTIC MATERIALS/BUY AMERICAN

Pursuant to N.J.S.A. 18A:18A-20, Contractor shall use only manufactured and farm products of the United States, wherever available.

19. SUBSTITUTION REQUESTS

Please refer to Specification Section 01300, "Submittals." "Or Equal" substitutions are permitted so long as they are equal to or superior to the basis of design and the Contractor takes full responsibility for all coordination and costs associated with collateral issues related to the substitution. No Substitutions will be reviewed during the bidding process. The Contractor takes full responsibility for all substitutions. Substitution submittals shall be made **no later than 30 days after Notice to Proceed** in order to provide time for comparison review. All submittals after 30 days shall be in strict accordance with the basis of design / specified products.

20. METHOD OF AWARD - LOWEST QUALIFIED BIDDER(S)

If at the time this Contract is to be awarded, the lowest responsive Base Bid (with any accepted alternates) submitted by a responsible bidder does not exceed the amount of funds then estimated by the Owner as available to finance the Contract the contract will be awarded. However, if said bid exceeds such amount, or other lawful cause exists, the Owner may reject all bids. The Owner also expressly reserves the right to reject all bids for any of the reasons set forth in N.J.S.A. 18A:18A-22.

21. Form AIA 101-2017 "Standard Form of Agreement Between Owner and Contractor" and AIA-A201-2017 "General Terms and Conditions" as modified by the Owner (and enclosed herein), shall be the standard agreement form used for Contracts for this project.

22. MANDATORY ELEC DISCLOSURE REQUIREMENT, P.L. 2005, CHAPTER 271
The Contractor is advised of its responsibility to file an annual disclosure statement on political contributions with the New Jersey Election Law Enforcement Commission (ELEC), pursuant to N.J.S.A. 19:44A-20.27 if the contractor receives contracts in excess of $50,000 from a public entity in a calendar year. It is the contractor's responsibility to determine if filing is necessary. Failure to so file can result in the imposition of financial penalties by ELEC. Additional information about this requirement is available from ELEC at 888-313-3532 or at www.elec.state.nj.us. In accordance with N.J.A.C. 6A:23A-6.3 the Board may not award a contract over $17,500 to a bidder that has made a reportable contribution to a member of the district board of education during the preceding one-year period. **The C.271 Political Disclosure Form is to be completed, certified and submitted prior to the award of contract.**

23. NON-COLLUSION AFFIDAVIT
The Owner is requesting that the Non-Collusion Affidavit be included with the bid, but the bidder must provide the Non-Collusion Affidavit prior to the award.

24. AMERICANS WITH DISABILITIES ACT, 42 U.S.C. 12101

The CONTRACTOR and the OWNER do hereby agree that the provisions of Title II of the Americans with Disabilities Act of 1990 (the "Act") (42 U.S.C. §12101 et seq.), which prohibits discrimination on the basis of disability by public entities in all services, programs and activities provided or made available by public entities, and the rules and regulations promulgated pursuant thereunto, are made a part of this contract. In providing any aid, benefit, or service on behalf of the OWNER pursuant to this contract, the CONTRACTOR agrees that the performance shall be in strict compliance with the Act. In the event that the CONTRACTOR, its agents, servants, employees, or subcontractors violate or are alleged to have violated the Act during the performance of this Contract, the CONTRACTOR shall defend the OWNER in any action or administrative proceeding commenced pursuant to the Act. The CONTRACTOR shall defend, indemnify, protect, and save harmless the OWNER, its agents, servants, and employees from and against any and all suits, claims, losses, demands, or damages, or whatever kind or nature arising out of or claimed to arise out of the alleged violation. The CONTRACTOR shall at its own expense, appear, defend, and pay any and all charges for legal services and any and all costs and other expenses arising from such action or administrative proceeding or incurred in connection therewith. In any and all complaints brought pursuant to the OWNER grievance procedure, the CONTRACTOR agrees to abide by any decision of the OWNER which is rendered pursuant to said grievance procedure. If any action or administrative proceeding results in an award of damages against the OWNER or if the OWNER incurs any expense to cure a violation of the ADA which has been brought pursuant to its grievance procedure, the CONTRACTOR shall satisfy and discharge the same at its own expense.

The OWNER shall, as soon as practicable after a claim has been made against it, give written notice thereof to the CONTRACTOR along with particulars of the claim then known by the OWNER. If any action or administrative proceedings is brought against the OWNER or any of its agents, servants, and employees, the OWNER shall expeditiously forward or have forwarded to the CONTRACTOR every demand, complaint, notice, summons, pleading, or other process received by the OWNER or its representatives. It is expressly agreed and understood that any approval by the OWNER of the services provided by the CONTRACTOR pursuant to this contact, or an independent violation by the OWNER, will not relieve the CONTRACTOR of the obligation to comply with the Act and to defend, indemnify, protect, and save harmless the OWNER pursuant to this paragraph. It is further agreed and understood that the OWNER assumes no obligation to indemnify or save harmless the CONTRACTOR, its agents, servants, employees and subcontractors for any claim which may arise out to their performance of this Agreement. Furthermore, the CONTRACTOR expressly understands and agrees that the provisions of this indemnification clause shall in no way limit the CONTRACTOR'S obligations assumed in this agreement, nor shall they be construed to relieve the CONTRACTOR from any liability, nor preclude the OWNER from taking any other actions available to it under any other provisions of the Agreement or otherwise at law.

25. NEW JERSEY OFFICE OF CLEAN ENERGY REBATE

During the performance of the contract, if and when requested by the Owner or the Owner's Representative, Contractor shall provide all required documentation including Submittals, Shop Drawings, and Cost Information (for materials and installation) for any equipment, systems or components, in order for the Owner to pursue Grants and Reimbursement through the New Jersey Office of Clean Energy. The Contractor may be required to provide detailed pricing information including invoices of materials and a breakdown of labor or equipment costs as it pertains to individual pieces of equipment, systems or components.

26. **STUDENT AND FACULTY SAFETY:**

During the performance of this contract, neither the Contractor nor any Subcontractor, where applicable, shall knowingly allow any employee registered pursuant to N.J.S.A. 2C:7-1, et seq. "Megan's Law," as a Tier 3 offender ("sex offenders determined to pose a relatively high risk of re-offense") or a Tier 2 offender ("sex offenders determined to pose a moderate risk of re-offense"), upon the Owner's property or the Project site.

The Contractor will be required to purchase for the Owner a Complete Visitor Management screening and badging system (LobbyGuard or approved equal) in order to conduct security checks on its employees and Subcontractors and to ensure compliance with these Student and Faculty Safety Requirements. The Contractor will be required to provide the Visitor Badge Labels for the duration of the contract. Following completion of the work, the security verification system shall be turned over to the Owner. All personnel of the Contractor will be required to wear picture identification badges in a visible manner while working on the Owner's premises; the badges must identify the individual and the firm with which the individual is employed. Contractors' personnel are to wear uniforms whenever possible. At the beginning of each workday, Contractor shall provide a list to Construction Manager of all of Contractor's personnel on-site that day.

All personnel or agents of the Contractor shall observe all rules and regulations in effect at the Owner's premises. For purposes of this section, Contractor's personnel includes the personnel of subcontractors of any tier. Contractors shall assume full responsibility for the actions of all their personnel. During the performance of this contract, neither the Contractor nor any Subcontractor, where applicable, shall knowingly allow any employee to enter any area of the Project where students or faculty are present, without first providing the Owner with a written list setting forth the identity of the employees. Contractors shall maintain proper supervision of the work in progress at all times. All personnel used by the Contractor for the performance of this work shall be properly trained and qualified for work of this type and shall have the minimum ability and experience for his classification. The Contractor shall provide evidence of qualifications for any personnel performing work under contract upon request. The Contractor shall ensure that all work is performed in such a manner that it does not disrupt the operation of the school or any students and/or staff on site.

Employees, personnel, or agents of the Contractor, while on the Owner's property, shall be subject to the control of the Owner, but under no circumstances shall such persons be deemed to be employees, personnel, or agents of the Owner. Contractor's personnel are not to engage with any activities with the students, staff or other Owner's employees unless duly authorized to do so in writing by the Business Administrator or Superintendent. Owner reserves the right to refuse to accept services from any personnel deemed by the Owner or its representative to be unqualified, disorderly, or unable to perform assigned work.

Owner (and/or the Owner's Representatives) reserves the right to direct the removal from the site of any person, equipment and/or entity Owner and/or Owner's Representative reasonably deems unfit or who/which displays inappropriate behavior, including but not limited to, alcohol consumption, drugs, fighting, intimidating or disruptive behavior, the use of language reasonably considered inappropriate on school grounds, harassing or biased or prejudiced behavior, negligent or reckless behavior, vandalism, theft, improper storage, or illegal acts. Such behaviors or actions by Contractor's personnel shall be deemed a violation of the terms of the contract by Contractor.

27. **CRIMINAL HISTORY BACKROUND CHECKS – N.J.S.A. 18A:6-7.1:**
The Contractor and all subcontractors of any tier for the project shall provide to the Owner evidence or proof that each worker assigned to the project that comes in regular contact with students, has had a criminal history background check, and that said check indicates that no criminal history record information exists on file for that worker.

The determination of "regular contact with students" will be made by the Owner. Failure to provide proof of criminal history background check for any contractor or subcontractor employee coming in regular contact with students shall be a violation of the terms of the contract.

If it is discovered during the course of the contract that a contractor or subcontractor employee has a disqualifying criminal history or the employee has not had a criminal history background check, that employee is to be removed from the project immediately.

28. Covid-19 and Health and Safety Requirements: All onsite personnel shall comply with the latest Federal, State and Local authorities having jurisdiction regarding Covid-19 and Health and Safety protocols.

29. The successful bidder shall, after contract award, comply with and complete all required forms, written authorizations and/or other information issued by the Owner for the disclosure of information in accordance with the mandates of N.J.S.A. 18A:6-7.7 et seq. which concerns prior acts and/or investigations of sexual misconduct and/or child abuse for those contracted service providers who are employed in positions which involve regular contact with students. The successful bidder is further notified that failure to provide truthful information or willfully failing to disclose information required by N.J.S.A. 18A:6-7.7 et seq., may subject the successful bidder to discipline up to, and including, termination or denial of employment; shall constitute a violation of the terms of the contract; may be a violation of N.J.S.A. 2C:28-3; and may be subject to a civil penalty of not more than $500, which shall be collected in proceedings in accordance with the "Penalty Enforcement Law of 1999," P.L. 1999, c. 274.

30. ANTI-BULLYING BILL OF RIGHTS – REPORTING OF HARRASSMENT, INTIMIDATION AND BULLYING – CONTRACTED SERVICE

The Contractor shall comply with all applicable provisions of the New Jersey Anti-Bullying Rights Act – N.J.S.A. 18A:37-13.1 et seq. and N.J.S.A. 18A:37-16, all applicable code and regulations, and the Anti-Bullying Policy of the Owner. The district shall provide to the contracted service provider a copy of the Owner's Anti-Bullying Policy.

In accordance with N.J.A.C. 6A:16-7.7 (c), a contracted service provider, who has witnessed, or has reliable information that a student has been subject to harassment, intimidations, or bullying shall report the incident to any school administrator or safe schools resource officer, or the School Business Administrator/Board Secretary, who shall immediately initiate the Owner's procedures concerning harassment, intimidation and bullying.

31. RECORD MAINTENANCE

Pursuant to N.J.A.C. 17:44-2.2, the Contractor shall maintain all documentation related to products, transactions or services under this Contract for a period of five years from the date of final payment. Such records shall be made available to the New Jersey Office of the State Comptroller upon request.

32. CONTRACTOR PERFORMANCE EVALUATION
In accordance with N.J.S.A. 18A:18A-15, when the entire cost of the project will exceed $20,000.00, the Board, through its authorized agent, shall upon the completion of the contract report to the Department of the Treasury as to the Contractor's performance, and shall also furnish such report from time to time during performance if the Contractor is then in default.

33. The Owner's officials and/or employees are precluded from taking part in the negotiations or the awarding of contracts to companies with which they may have a financial or personal interest.

34. The Owner represents that none of its employees, and to the best of its knowledge, none of its contracted parties or employees of its contracted parties, are engaged in any conduct that would constitute a conflict of interest or a violation of the School Ethics Act.

35. The Contractor and its Subcontractors may be debarred, suspended or disqualified from contracting and/or working on the School Facilities Project if found to have committed any of the acts listed in N.J.A.C. 17:19-4.1.

36. The Owner shall keep those records and accounts and shall require all Contracted Parties including the Contractor and Subcontractors to keep those records and accounts for the School Facilities Projects as necessary in order to evidence compliance with the Public Schools Contracts Law.

37. The Contractor agrees to retain during the term of the Contract and for 10 years after closeout thereafter all financial records, supporting documents and other records which relate in any way to the work. If any litigation, claim or audit is commenced prior to the expiration date, such records and documents shall be retained by the Contractor until all litigation, claims or audit findings involving the records have been resolved.

END OF SECTION

BID FORM

DATE: _____

Bidder's Information: (Print or Type)

Company Name: _____

Contact Name: _____

Contact Email Address: _____

Company Address: _____

_____

Telephone Number: _____ Fax Number:_____

The Board of Education of the Special Services School District and
the Vocational Technical School District of the
County of Salem
880 Route 45
Woodstown, NJ 08098

This Proposal is submitted in accordance with your Notice to Bidders inviting proposals to be received for the **Salem Career and Technical High School 2024 Addition and Renovations**. Having carefully examined the Contract Documents and being familiar with various conditions affecting the work, the undersigned herein agrees to furnish all materials, perform all labor and do all else necessary to complete the **ENTIRE PROJECT** in accordance with said Contract Documents for the **LUMP SUM BASE BID (including the allowance) OF**:

BID AMOUNT $_____

PLUS CASH ALLOWANCE
SECTION 01210 - ALLOWANCES ITEM A $ 100,000.00

TOTAL BASE BID (In Numbers) (Bid Amount and the Allowances) $_____

(In words)_____

Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words shall govern.

BID FORM

UNIT PRICES

A Unit price is an amount proposed by bidders, stated herein, as a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if the estimated quantities of Work required by the Contract Documents are increased or decreased.

Unit prices include all necessary material to fully furnish, plus cost for delivery, installation, insurance, overhead, profit, and applicable taxes. The prices shown in the schedule are for additions and deductions to the contract.

Measurement and Payment: Refer to individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections. The Owner reserves the right to reject the Bidder's measurement of work-in-place that involves use of established unit prices, and to have this work measured, at the Owner's expense, by an independent surveyor acceptable to the Bidder.

UNIT PRICE SCHEDULE: The Bidder shall submit a price for each item listed below. Fill in "$0,00" if no cost is associated with a particular line item. A blank space next to a particular line item shall mean that there is no cost associated with such line item.

1. Provide a unit price for Soil Cement Modification for areas that have been deemed necessary by the 3rd party Testing Firm, and with the approval of the engineer and owner. Soil Cement Modification to be performed if and where Directed (IAWD) after proof-rolling and inspection.

   $_____ Per SY

SUBCONTRACTOR DISCLOSURE

The Board of Education of the Special Services School District and the Vocational Technical School District of the County of Salem hereinafter called "Owner" in accordance with bidding requirements for the work titled **Salem Career and Technical High School 2024 Addition and Renovations** for the portions of the Work below listed, the undersigned proposes to use the following Prime Subcontractors (indicate "Self-Performing" if you are doing the portion of the work required – please note you must be Pre-Qualified for the work to be "Self-Performing") pursuant to N.J.S.A. 18A:18A-18:

PORTION OF WORK	PRIME SUBCONTRACTOR'S NAME AND ADDRESS
General Construction Work (C008 or C009)	
Structural Steel Work (C029)	
Heating and Ventilating Systems and Equipment (C032)	
Plumbing Work (C030)	
Electrical Work (C047)	

The Prime Subcontractors listed above must be registered pursuant to the Public Works Contractor Registration Act (N.J.S.A. 34:11-56.48 et seq.) and DPMC pre-qualified at the time of bid submission. The Bidder shall provide with his/her Bid for each such Prime Subcontractor listed above (OR HIMSELF/HERSELF IF SELF-PERFORMING) a Total Amount of Uncompleted Contracts Affidavit (form DPMC 701). The Owner is requesting that the Bidder provide a valid and active DPMC Notice of Classification, No Material Adverse Change in Qualification Form, Public Works Contractor Registration Certificate and a Business Registration Form with the bid as well, but shall provide these no later than the time of award.

BID FORM

The undersigned hereby certifies that this Proposal is genuine and not sham or collusive or made in the interest of or in behalf of any person, firm or corporation not herein named and that the undersigned has not directly or indirectly induced or solicited any bidder to refrain from bidding and that the undersigned has not in any manner sought by collusion to secure for himself any advantages over any other bidder.

The undersigned, intending to be legally bound, agrees that this Proposal shall be irrevocable and shall remain subject to your acceptance for 60 days after date set for bid opening.

The undersigned submits this Proposal with the full knowledge of the Contract requirements and hereby agrees that the work of this Project, under the Contract, shall be fully and finally completed and ready for occupancy in accordance with the date found in Specification Section 01010 – Summary of Work.

_____

NAME OF BIDDER

_____ _____

SIGNATURE DATE

ACKNOWLEDGMENT OF RECEIPT OF ADDENDA / CLARIFICATIONS

The undersigned Bidder hereby acknowledges receipt of the following Addenda:

Addendum Number	Dated
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Clarification Number	Dated
_____	_____
_____	_____
_____	_____

☐ Check here if No Addenda / Clarifications were issued.

Acknowledged for: _____
(Name of Bidder)

By: _____
(Signature of Authorized Representative)

Name: _____

Title: _____

FAILURE TO COMPLETE AND RETURN THIS FORM WITH YOUR BID SUBMISSION SHALL BE CAUSE FOR YOUR BID TO BE REJECTED

STATEMENT OF OWNERSHIP
(OWNERSHIP DISCLOSURE CERTIFICATION)
N.J.S.A. 52:25-24.2 (P.L. 1977, c.33, as amended by P.L. 2016, c.43)

This Statement Shall Be Included with All Bid and Proposal Submissions

Name of Business: _____

Address of Business: _____

Name of person completing this form: _____

N.J.S.A. 52:25-24.2:

"No corporation, partnership, or limited liability company shall be awarded any contract nor shall any agreement be entered into for the performance of any work or the furnishing of any materials or supplies, the cost of which is to be paid with or out of any public funds, by the State, or any county, municipality or school district, or any subsidiary or agency of the State, or of any county, municipality or school district, or by any authority, board, or commission which exercises governmental functions, unless prior to the receipt of the bid or proposal, or accompanying the bid or proposal of said corporation, said partnership, or said limited liability company there is submitted a statement setting forth the names and addresses of all stockholders in the corporation who own 10 percent or more of its stock, of any class, or of all individual partners in the partnership who own a 10 percent or greater interest therein, or of all members in the limited liability company who own a 10 percent or greater interest therein, as the case may be.

If one or more such stockholder or partner or member is itself a corporation or partnership or limited liability company, the stockholders holding 10 percent or more of that corporation's stock, or the individual partners owning 10 percent or greater interest in that partnership, or the members owning 10 percent or greater interest in that limited liability company, as the case may be, shall also be listed. The disclosure shall be continued until names and addresses of every non-corporate stockholder, and individual partner, and member, exceeding the 10 percent ownership criteria established in this act, has been listed.

To comply with this section, a bidder with any direct or indirect parent entity which is publicly traded may submit the name and address of each publicly traded entity and the name and address of each person that holds a 10 percent or greater beneficial interest in the publicly traded entity as of the last annual filing with the federal Securities and Exchange Commission or the foreign equivalent, and, if there is any person that holds a 10 percent or greater beneficial interest, also shall submit links to the websites containing the last annual filings with the federal Securities and Exchange Commission or the foreign equivalent and the relevant page numbers of the filings that contain the information on each person that holds a 10 percent or greater beneficial interest."

This Ownership Disclosure Certification form shall be completed, signed and notarized.
Failure of the bidder/proposer to submit the required information is cause for automatic rejection of the bid or proposal.

Part I

Check the box that represents the type of business organization:

☐ Sole Proprietorship

☐ Non-Profit Corporation (skip Parts II and III, sign and notarize at the end)

☐ Partnership ☐ Limited Partnership ☐ Limited Liability Partnership

☐ Limited Liability Company

☐ For-profit Corporation (including Subchapters C and S or Professional Corporation)

☐ Other (be specific): _____

Part II

☐ I certify that the list below contains the names and addresses of all stockholders in the corporation who own ten percent (10%) or more of its stock, of any class, or of all individual partners in the partnership who own a ten percent (10%) or greater interest therein, or of all members in the limited liability company who own a ten percent (10%) or greater interest therein, as the case may be.

OR

☐ I certify that no one stockholder in the corporation owns 10 percent or more of its stock, of any class, or no individual partner in the partnership owns a 10 percent or greater interest therein, or that no member in the limited liability company owns a 10 percent or greater interest therein, as the case may be.

Sign and notarize the form below, and complete the list below. The disclosure shall be continued until names and addresses of every non-corporate stockholder, and individual partner, and member, meeting or exceeding the 10 percent ownership criteria established in N.J.S.A. 52:25-24.2, has been listed. (Please attach additional sheets if more space is needed):

Name: _____ Name: _____

Address: _____ Address: _____

_____ _____

Name: _____ Name: _____

Address: _____ Address: _____

_____ _____

Name: _____ Name: _____

Address: _____ Address: _____

_____ _____

Name: _____ Name: _____

Address: _____ Address: _____

_____ _____

Name: _____ Name: _____

Address: _____ Address: _____

_____ _____

Part III - Ten Percent Owners of Owners Identified in Part II:

"To comply with this section, a bidder with any direct or indirect parent entity which is publicly traded may submit the name and address of each publicly traded entity and the name and address of each person that holds a ten percent (10%) or greater beneficial interest in the publicly traded entity as of the last annual filing with the federal Securities and Exchange Commission or the foreign equivalent filing, and, if there is any person that holds a ten percent (10%) or greater beneficial interest, also shall submit links to the websites containing the last annual filings with the federal Securities and Exchange Commission or the foreign equivalent filing, and the relevant page numbers of the filings that contain the information on each person that holds a ten percent (10%) or greater beneficial interest."

☐ Pages attached with name and address of each publicly traded entity as well as the name and address of each person that holds a ten percent (10%) or greater beneficial interest.

AND

☐ Submit here the links to the Websites (URLs) containing the last annual filings with the federal Securities and Exchange Commission or the foreign equivalent.

_____

_____

AND

☐ Submit here the relevant page numbers of the filings containing the information on each person holding a 10 percent or greater beneficial interest.

_____

_____

AND

List the names and addresses of each stockholder, partner or member owning a ten percent (10%) or greater interest in any corresponding corporation, partnership and/or limited liability company listed in Part II **other than for any publicly traded parent entities referenced above**. The disclosure shall be continued until names and addresses of every noncorporate stockholder, and individual partner, and member meeting or exceeding the ten percent (10%) ownership criteria established pursuant to N.J.S.A. 52:25-24.2 has been listed. **Attach additional sheets if more space is needed.**

Stockholder/Partner/Member and Corresponding Entity Listed in Part II	**Address**

Subscribed and sworn before me this ___ day of _____, 20_____.

(Notary Public)

My Commission expires:

_____
(Affiant)

_____
(Print name of affiant and title if applicable)

(Corporate Seal if a Corporation)

BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned, _____
Company Name

_____
Company Address

as Principal, and _____
Surety Company Name

_____
Surety Company Address

as Surety, are hereby and firmly bound unto **the Board of Education of the Special Services School District and the Vocational Technical School District of the County of Salem, 880 Route 45, Woodstown, New Jersey 08098** as Owner, in the penal sum of Ten Percent of the Amount of Bid Not to Exceed Twenty Thousand and 00/100 Dollars (10% Not to Exceed $20,000.00) for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

Signed, this _____ Day of _____, 20_____.

The condition of the above obligation is such that, whereas the Principal has submitted to **the Board of Education of the Special Services School District and the Vocational Technical School District of the County of Salem** a certain bid, attached hereto and hereby made a part hereof to enter into a contract in writing for the **Salem County Career and Technical High School 2024 Addition and Renovations.**

NOW, THEREFORE,

(a) If said Bid shall be rejected, or in the alternate,

(b) If said Bid shall be accepted and the Principal shall execute and deliver an AIA Document A101 Standard Form of Agreement Between Owner and Contractor (properly completed and amended in accordance with said Bid) and shall furnish bonds for his faithful performance of said contract, and for the payment of all persons performing labor or furnishing materials in connection therewith, and shall in all other respects perform the agreement created by the acceptance of the Bid,

then this obligation shall be void, otherwise the same shall remain in force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims thereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received, hereby stipulates and agrees that the obligation of said Surety and its bond shall be in no way impaired or affected by an extension of the time within which the Owner may accept such bid; and said Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper offer, the day and year first set forth above.

_____
Company Name

Attest / Witness

_____
Signature

By: _____
Signature

_____
Name and Title

_____
Surety Company Name

_____
Signature

By: _____
Signature

_____
Name and Title

ANY BOND COMPLYING WITH THE REQUIREMENTS OF N.J.S.A 18A:18A-24 MAY BE USED.

CONSENT OF SURETY

The _____

_____

_____

(Name and Address of Surety)

a corporation existing under the Laws of the State of _____

and authorized to do business under the Laws of the State of New Jersey, hereby certifies that application has been made to us by

_____

_____

_____

(Name and Address of Contractor)

and satisfactory arrangements have been completed by which we have and do now agree to furnish a Performance Bond, Payment Bond, and Maintenance Bond each equal to 100% of the Contract price to ensure the faithful performance on the part of the Bidder of the terms and conditions of the contract.

Title of the Work: Salem County Career and Technical High School 2024 Addition and Renovations

Location of the Project: 880 Route 45, Woodstown, New Jersey 08098

This proposition is made with the understanding that any change made in the specifications or agreements without the consent of the bondsman shall in no way vitiate the bond.

WITNESS:

_____

SURETY COMPANY

_____

(Name of Surety Company)

Title: _____

(Attorney-in-fact)

By: _____

Date: _____

(Affix corporate seal)

IMPORTANT NOTE

The Surety Company executing the Bond must be authorized to transact business in the State of New Jersey. For contracts in excess of $850,000, the Surety shall be listed on the Treasury Department's most current New Jersey List of Approved Sureties, located at www.state.nj.is/dobi/surety.htm.

ANY FORM CONSENT OF SURETY COMPLYING WITH THE REQUIREMENTS OF N.J.S.A. 18A:18A-25 MAY BE USED.

State of New Jersey

DEPARTMENT OF THE TREASURY
DIVISION OF PROPERTY MANAGEMENT AND CONSTRUCTION
33 W. STATE STREET
PO BOX 034
TRENTON, NEW JERSEY 08625-0034

REPLY TO:
TEL: (609) 943-3400
FAX: (609) 292-7651

TOTAL AMOUNT OF UNCOMPLETED CONTRACTS

(This form is to be used with the NOTICE OF CLASSIFICATION when submitting bids to the Department of Education.)

I Certify that the amount of uncompleted work on contracts is $ _____ .

The amount claimed includes uncompleted portions of all currently held contracts from all sources (public and private) in accordance with N.J.A.C. 17:19-2.13.

I further certify that the amount of this bid proposal, including all outstanding incomplete contracts does not exceed my prequalification dollar limit.

Affix corporate seal here

Respectfully submitted,

By _____
Name of Firm

_____
Signature

_____
Title

Sworn to and subscribed before me This day of 20

Notary Public

_____
Business Address

_____

_____

_____
Phone

DPMC 701 (3/15)

NO MATERIAL ADVERSE CHANGE IN QUALIFICATION

AFFIDAVIT

I, _____ being of full age under oath depose and say:

1. I am a(n) owner, partner, shareholder or officer of the company set forth below and am duly authorized to execute this affidavit on its behalf.

2. A statement as to the financial ability, adequacy of plant and equipment, organization and prior experience of [Bidder/Prime Subcontractor], as required by N.J.S.A. 18A:18A-28 has been submitted to the Department of Treasury within one (1) year preceding the date of opening of bids for this contract.

3. I certify, as required by N.J.S.A. 18A:18A-32 that there has been no material adverse change in the qualification information of [Bidder/Prime Subcontractor] since such statement was submitted to the Department of Treasury except:

_____

_____.

SEAL

_____
SIGNATURE

_____
TITLE

_____
COMPANY

_____
DATE

Sworn to and subscribed
before me this day
of _____, 20____.

_____
Notary Public

HOLD HARMLESS AGREEMENT

It is further agreed that the undersigned hereby agrees to defend, indemnify and hold harmless the Board of Education, its officers, employees, volunteers and agents, from and against all claims, damages, losses, and expenses, including reasonable attorney's fees and costs, in case it shall be necessary to file an action or claim or in case an action or claim is brought or made which is; 1) for personal or bodily injury, illness or death, for property damage, including loss of use, or for any economic loss and; 2) caused in whole or in part by _____ (Name of Bidder's) alleged negligent acts or omissions, breaches of contract, or otherwise arising out of their work, or those of a subcontractor, or that of anyone employed by them, or for whose acts contractor or subcontractor may be liable. Contractor's obligation hereunder shall apply in all instances whether the Board of Education, its officers, employees, volunteers and/or agents is/are made a party to the action or claim or is subsequently made a party to the action by third-party in-pleading or is made a part to a collateral action arising, in whole or in part, from any of the issues emanating from the original cause of action or claim. The contractor's obligation hereunder shall apply even when such claims, damages, losses and expenses are caused in part by the Board of Education, its officers, employees, volunteers or agents.

Full Name of Contractor: _____

Business Address: _____

Telephone Number: (____)_____ Zip Code_____

Project Description: _____

Signature / Authorized Person _____

Print Name: _____

Witness Signature _____

Print Name: _____

CERTIFICATION REGARDING THE DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION

I am _____ of the firm of _____,
(your title) (name of your organization)

_____.
(state the address of your organization)

CHOOSE ONE OF THE FOLLOWING

( ) A. I hereby certify on behalf of _____ that
(name of your organization)

neither it nor its principals are presently debarred, suspended, declared ineligible, subject to notice that debarment is being considered or reviewed or may be imposed, or voluntarily excluded from public contracting by the State of New Jersey, any department or agency thereof, or any Federal department or agency.

( ) B. I am unable to certify to any of the statements set forth in this certification. I have attached an explanation to this form.

_____
(Signature)

_____
(Type Name & Title)

_____
(Date)

CERTIFICATION REGARDING THE DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION

INSTRUCTIONS FOR CERTIFICATION

1. By signing and submitting this certification, the contracting firm is providing the certification as set out above.
2. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the contracting firm knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the District may pursue available remedies including suspension and/or debarment.
3. The contracting firm shall provide immediate written notice to the District if at any time it learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.
4. The terms "covered transaction", "debarred", "suspended", "ineligible", "lower tier covered transaction", "participant", "person", "primary covered transaction", "principal", and "voluntarily excluded", as used in this certification, have the meanings set out in the Definitions and Coverage sections of rules implementing Executive Order 12549. You may contact the District for assistance in obtaining a copy of those regulations.
5. The contracting firm agrees by submitting this certification that, should the covered transaction be entered into, it shall not knowingly enter into any transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction.
6. The contracting firm further agrees by submitting this certification that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion" without modification, in all subcontracts to this agreement as authorized by the District.
7. The Contractor may be debarred, suspended or disqualified from contracting and/or working on the Work if found to have committed any of the acts listed in N.J.A.C. 17:19-4.1. The Contractor shall insert in all of its contracts with subcontractors a clause stating that the subcontractor may be debarred, suspended or disqualified from contracting and/or working on the Work if found to have committed any of the acts listed in N.J.A.C. 17.19-4.1 .
8. All Bidders shall submit a sworn statement indicating whether the Bidder, at the time of the Bid, is included on the State Treasurer's, or the Federal Government's List of Debarred, Suspended or Disqualified Bidders as a result of action taken by any State or Federal Agency. The Owner shall immediately notify the State of New Jersey and the Unit of Fiscal Integrity of the Office of the Attorney General whenever it appears that a bidder is on the State Treasurer's or the Federal Government's List.

STANDARD BID DOCUMENT REFERENCE	
Name of Form:	**FEDERAL NON-DEBARMENT CERTIFICATION**
Statutory Reference:	N.J.S.A. 52:32-44.1 (P.L. 2019, c.406)
Description:	Meets statutory criteria for certification of non-debarment by a federal government agency.

Summary of the Certification Requirements under N.J.S.A. 52:32-44.1

Pursuant to state law any natural person, company, firm, association, corporation, or other entity prohibited, or "debarred," from contracting with the federal government agencies, shall also be prohibited from contracting for public work in the state of New Jersey. This prohibition also extends to any affiliate organization(s) held by or subject to the control of an entity of that prohibited person or entity.

Prior to awarding a contract for public work a local units must obtain written certification from the contracting person or entity through the form below, attesting to their non-debarment from contracting with federal government agencies. Contracting units are reminded that they must fill-in the boilerplate information in the certification sections of Parts II through IV regarding their name and type of contracting unit before using the form.

CERTIFICATION OF NON-DEBARMENT FOR FEDERAL GOVERNMENT CONTRACTS

N.J.S.A. 52:32-44.1 (P.L. 2019, c.406)

This certification shall be completed, certified to, and submitted to the contracting unit prior to contract award, except for emergency contracts where submission is required prior to payment.

PART I: VENDOR INFORMATION	
Individual or Organization Name	
Physical Address of Individual or Organization	
Unique Entity ID (if applicable)	
CAGE/NCAGE Code (if applicable)	
Check the box that represents the type of business organization:	

☐Sole Proprietorship (skip Parts III and IV) ☐Non-Profit Corporation (skip Parts III and IV)

☐For-Profit Corporation (any type) ☐Limited Liability Company (LLC) ☐Partnership

☐Limited Partnership ☐Limited Liability Partnership (LLP)

☐Other (be specific): _____

PART II – CERTIFICATION OF NON-DEBARMENT: Individual or Organization			
I hereby certify that the **individual or organization listed above in Part I** is not debarred by the federal government from contracting with a federal agency. I further acknowledge: that I am authorized to execute this certification on behalf of the above-named organization; that the Board of Education of the Special Services School District and the Vocational Technical School District of the County of Salem is relying on the information contained herein and that I am under a continuing obligation from the date of this certification through the date of contract award by the Board of Education to notify the Board of Education in writing of any changes to the information contained herein; that I am aware that it is a criminal offense to make a false statement or misrepresentation in this certification, and if I do so, I am subject to criminal prosecution under the law and that it will constitute a material breach of my agreement(s) with the Board of Education, permitting the Board of Education to declare any contract(s) resulting from this certification void and unenforceable.			
Full Name (Print):		Title:	
Signature:		Date:	

PART III – CERTIFICATION OF NON-DEBARMENT: Individual or Entity Owning Greater than 50 Percent of Organization	
Section A (Check the Box that applies)	
☐	Below is the name and address of the stockholder in the corporation who owns more than 50 percent of its voting stock, or of the partner in the partnership who owns more than 50 percent interest therein, or of the member of the limited liability company owning more than 50 percent interest therein, as the case may be.
Name of Individual or Organization	
Physical Address	
OR	
☐	No one stockholder in the corporation owns more than 50 percent of its voting stock, or no partner in the partnership owns more than 50 percent interest therein, or no member in the limited liability company owns more than 50 percent interest therein, as the case may be.
Section B (Skip if no Business entity is listed in Section A above)	
☐	Below is the name and address of the stockholder in the corporation who owns more than 50 percent of the voting stock of the organization's parent entity, or of the partner in the partnership who owns more than 50 percent interest in the organization's parent entity, or of the member of the limited liability company owning more than 50 percent interest in organization's parent entity, as the case may be.
Stockholder/Partner/Member Owning Greater Than 50 Percent of Parent Entity	
Physical Address	
OR	
☐	No one stockholder in the parent entity corporation owns more than 50 percent of its voting stock, no partner in the parent entity partnership owns more than 50 percent interest therein, or no member in the parent entity limited liability company owns more than 50 percent interest therein, as the case may be.

Section C – Part III Certification			
I hereby certify that no individual or organization that is debarred by the federal government from contracting with a federal agency owns greater than 50 percent of the **Organization listed above in Part I** or, if applicable, owns greater than 50 percent of a parent entity of **<name of organization>**. I further acknowledge: that I am authorized to execute this certification on behalf of the above-named organization; that the Board of Education of the Special Services School District and the Vocational Technical School District of the County of Salem is relying on the information contained herein and that I am under a continuing obligation from the date of this certification through the date of contract award the Board of Education notify the Board of Education in writing of any changes to the information contained herein; that I am aware that it is a criminal offense to make a false statement or misrepresentation in this certification, and if I do so, I am subject to criminal prosecution under the law and that it will constitute a material breach of my agreement(s) with the Board of Education permitting the Board of Education to declare any contract(s) resulting from this certification void and unenforceable.			
Full Name (Print):		Title:	
Signature:		Date:	

Part IV – CERTIFICATION OF NON-DEBARMENT: Contractor – Controlled Entities		
Section A		
☐	Below is the name and address of the corporation(s) in which the **Organization listed in Part I** owns more than 50 percent of voting stock, or of the partnership(s) in which the **Organization listed in Part I** owns more than 50 percent interest therein, or of the limited liability company or companies in which the **Organization listed above in Part I** owns more than 50 percent interest therein, as the case may be.	
Name of Business Entity		**Physical Address**
Add additional sheets if necessary		
OR		
☐	The **Organization listed above in Part I** does not own greater than 50 percent of the voting stock in any corporation and does not own greater than 50 percent interest in any partnership or any limited liability company.	

Section B (skip if no business entities are listed in Section A of Part IV)		
☐	Below are the names and addresses of any entities in which an entity listed in Part III A owns greater than 50 percent of the voting stock (corporation) or owns greater than 50 percent interest (partnership or limited liability company).	
Name of Business Entity Controlled by Entity Listed in Section A of Part IV		**Physical Address**
Add additional Sheets if necessary		
OR		
☐	No entity listed in Part III A owns greater than 50 percent of the voting stock in any corporation or owns greater than 50 percent interest in any partnership or limited liability company.	

Section C – Part IV Certification

I hereby certify that the **Organization listed above in Part I** does not own greater than 50 percent of any entity that that is debarred by the federal government from contracting with a federal agency and, if applicable, does not own greater than 50 percent of any entity that in turns owns greater than 50 percent of any entity debarred by the federal government from contracting with a federal agency. I further acknowledge: that I am authorized to execute this certification on behalf of the above-named organization; that the Board of Education of the Special Services School District and the Vocational Technical School District of the County of Salem is relying on the information contained herein and that I am under a continuing obligation from the date of this certification through the date of contract award by the Board of Education to notify the Board of Education in writing of any changes to the information contained herein; that I am aware that it is a criminal offense to make a false statement or misrepresentation in this certification, and if I do so, I am subject to criminal prosecution under the law and that it will constitute a material breach of my agreement(s) with the Board of Education permitting the Board of Education to declare any contract(s) resulting from this certification void and unenforceable.

Full Name (Print):		Title:	
Signature:		Date:	

AFFIRMATIVE ACTION REQUIREMENTS

Bidder is required to comply with the requirements of N.J.S.A. 10:5-31 et seq. and N.J.A.C. 17:27.

1. After notification of award, but prior to signing a construction contract, the contractor shall submit to the public agency compliance officer and the Dept. of LWD, Construction EEO Monitoring Program an Initial Project Workforce Report (Form AA-201) electronically provided to the public agency by the Dept. of LWD, Construction EEO Monitoring Program, through its web-site, for distribution to and completion by the contractor, in accordance with N.J.A.C. 17:27-7.

2. The contractor also agrees to submit a copy of the Monthly Project Workforce Report once a month thereafter for the duration of this contract to the Dept. of LWD, Construction EEO Monitoring Program, and to the public agency compliance officer.

The undersigned certifies that he/she is aware of the commitment to comply with the requirements of N.J.S.A. 10:5-31 et seq. and N.J.A.C. 17:27 et seq. and agrees to furnish the required forms of evidence.

Subscribed and sworn to before me this

_____day of _____, 202__,

My Commission expires:

_____

Date

_____

Signature

_____

Name and Title
(Type or Print)

EXHIBIT B

MANDATORY EQUAL EMPLOYMENT OPPORTUNITY LANGUAGE
N.J.S.A. 10:5-31 et seq. (P.L.1975, c.127) N.J.A.C. 17:27-1.1 et seq.

CONSTRUCTION CONTRACTS

During the performance of this contract, the contractor agrees as follows:

The contractor or subcontractor, where applicable, will not discriminate against any employee or applicant for employment because of age, race, creed, color, national origin, ancestry, marital status, affectional or sexual orientation, gender identity or expression, disability, nationality or sex. Except with respect to affectional or sexual orientation and gender identity or expression, the contractor will ensure that equal employment opportunity is afforded to such applicants in recruitment and employment, and that employees are treated during employment, without regard to their age, race, creed, color, national origin, ancestry, marital status, affectional or sexual orientation, gender identity or expression, disability, nationality or sex. Such equal employment opportunity shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the Public Agency Compliance Officer setting forth provisions of this nondiscrimination clause.

The contractor or subcontractor, where applicable will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to age, race, creed, color, national origin, ancestry, marital status, affectional or sexual orientation, gender identity or expression, disability, nationality or sex.

The contractor or subcontractor will send to each labor union, with which it has a collective bargaining agreement, a notice, to be provided by the agency contracting officer, advising the labor union or workers' representative of the contractor's commitments under this act and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

The contractor or subcontractor, where applicable, agrees to comply with any regulations promulgated by the Treasurer, pursuant to N.J.S.A. 10:5-31 et seq., as amended and supplemented from time to time and the Americans with Disabilities Act.

When hiring or scheduling workers in each construction trade, the contractor or subcontractor agrees to make good faith efforts to employ minority and women workers in each construction trade consistent with the targeted employment goal prescribed by N.J.A.C. 17:27-7.2; provided, however, that the Dept. of LWD, Construction EEO Monitoring Program, may, in its discretion, exempt a contractor or subcontractor from compliance with the good faith procedures prescribed by the following provisions, A, B, and C, as long as the Dept. of LWD, Construction EEO Monitoring Program is satisfied that the contractor or subcontractor is employing workers provided by a union which provides evidence, in accordance with standards prescribed by the Dept. of LWD, Construction EEO Monitoring Program, that its percentage of active "card carrying" members who are minority and women workers is equal to or greater than the targeted employment goal established in accordance with N.J.A.C. 17:27-7.2. The contractor or subcontractor agrees that a good faith effort shall include compliance with the following procedures:

(A) If the contractor or subcontractor has a referral agreement or arrangement with a union for a construction trade, the contractor or subcontractor shall, within three business days of the contract award, seek assurances from the union that it will cooperate with the contractor or subcontractor as it fulfills its affirmative action obligations under this contract and in accordance with the rules promulgated by the Treasurer pursuant to N.J.S.A. 10:5-31 et. seq., as supplemented and amended from time to time and the Americans with Disabilities Act. If the contractor or subcontractor is unable to obtain said assurances from the construction trade union at least five business days prior to the commencement of construction work, the contractor or subcontractor agrees to afford equal employment opportunities minority and women workers directly, consistent with this chapter. If the contractor's or subcontractor's prior experience with a construction trade union, regardless of whether the union has provided said assurances, indicates a significant possibility that the trade union will not refer sufficient minority and women workers consistent with affording equal employment opportunities as specified in this chapter, the contractor or subcontractor agrees to be prepared to provide such opportunities to minority and women workers directly, consistent with this chapter, by complying with the hiring or scheduling procedures prescribed under (B) below; and the contractor or subcontractor further agrees to take said action immediately if it determines that the union is not referring minority and women workers consistent with the equal employment opportunity goals set forth in this chapter.

(B) If good faith efforts to meet targeted employment goals have not or cannot be met for each construction trade by adhering to the procedures of (A) above, or if the contractor does not have a referral agreement or arrangement with a union for a construction trade, the contractor or subcontractor agrees to take the following actions:

(l) To notify the public agency compliance officer, the Dept. of LWD, Construction EEO Monitoring Program, and minority and women referral organizations listed by the Division pursuant to N.J.A.C. 17:27-5.3, of its workforce needs, and request referral of minority and women workers;

(2) To notify any minority and women workers who have been listed with it as awaiting available vacancies;

(3) Prior to commencement of work, to request that the local construction trade union refer minority and women workers to fill job openings, provided the contractor or subcontractor has a referral agreement or arrangement with a union for the construction trade;

(4) To leave standing requests for additional referral to minority and women workers with the local construction trade union, provided the contractor or subcontractor has a referral agreement or arrangement with a union for the construction trade, the State Training and Employment Service and other approved referral sources in the area;

(5) If it is necessary to lay off some of the workers in a given trade on the construction site, layoffs shall be conducted in compliance with the equal employment opportunity and nondiscrimination standards set forth in this regulation, as well as with applicable Federal and State court decisions;

(6) To adhere to the following procedure when minority and women workers apply or are referred to the contractor or subcontractor:

(i) The contactor or subcontractor shall interview the referred minority or women worker.

(ii) If said individuals have never previously received any document or certification signifying a level of qualification lower than that required in order to perform the work of the construction trade, the contractor or subcontractor shall in good faith determine the qualifications of such individuals. The contractor or subcontractor shall hire or schedule those individuals who satisfy appropriate qualification standards in conformity with the equal employment opportunity and non-discrimination principles set forth in this chapter. However, a contractor or subcontractor shall determine that the individual at least possesses the requisite skills, and experience recognized by a union, apprentice program or a referral agency, provided the referral agency is acceptable to the Dept. of LWD, Construction EEO Monitoring Program. If necessary, the contractor or subcontractor shall hire or schedule minority and women workers who qualify as trainees pursuant to these rules. All of the requirements, however, are limited by the provisions of (C) below.

(iii) The name of any interested women or minority individual shall be maintained on a waiting list, and shall be considered for employment as described in (i) above, whenever vacancies occur. At the request of the Dept. of LWD, Construction EEO Monitoring Program, the contractor or subcontractor shall provide evidence of its good faith efforts to employ women and minorities from the list to fill vacancies.

(iv) If, for any reason, said contractor or subcontractor determines that a minority individual or a woman is not qualified or if the individual qualifies as an advanced trainee or apprentice, the contractor or subcontractor shall inform the individual in writing of the reasons for the determination, maintain a copy of the determination in its files, and send a copy to the public agency compliance officer and to the Dept. of LWD, Construction EEO Monitoring Program.

(7) To keep a complete and accurate record of all requests made for the referral of workers in any trade covered by the contract, on forms made available by the Dept. of LWD, Construction EEO Monitoring Program and submitted promptly to the Dept. of LWD, Construction EEO Monitoring Program upon request.

(C) The contractor or subcontractor agrees that nothing contained in (B) above shall preclude the contractor or subcontractor from complying with the union hiring hall or apprenticeship policies in any applicable collective bargaining agreement or union hiring hall arrangement, and, where required by custom or agreement, it shall send journeymen and trainees to the union for referral, or to the apprenticeship program for admission, pursuant to such agreement or arrangement. However, where the practices of a union or apprenticeship program will result in the exclusion of minorities and women or the failure to refer minorities and women consistent with the targeted county employment goal, the contractor or subcontractor shall consider for employment persons referred pursuant to (B) above without regard to such agreement or arrangement; provided

further, however, that the contractor or subcontractor shall not be required to employ women and minority advanced trainees and trainees in numbers which result in the employment of advanced trainees and trainees as a percentage of the total workforce for the construction trade, which percentage significantly exceeds the apprentice to journey worker ratio specified in the applicable collective bargaining agreement, or in the absence of a collective bargaining agreement, exceeds the ratio established by practice in the area for said construction trade. Also, the contractor or subcontractor agrees that, in implementing the procedures of (B) above, it shall, where applicable, employ minority and women workers residing within the geographical jurisdiction of the union.

After notification of award, but prior to signing a construction contract, the contractor shall submit to the public agency compliance officer and the Dept. of LWD, Construction EEO Monitoring Program an initial project workforce report (Form AA-201) electronically provided to the public agency by the Dept. of LWD, Construction EEO Monitoring Program, through its website, for distribution to and completion by the contractor, in accordance with N.J.A.C. 17:27-7. The contractor also agrees to submit a copy of the Monthly Project Workforce Report once a month thereafter for the duration of this contract to the Dept. of LWD, Construction EEO Monitoring Program, and to the public agency compliance officer. The contractor agrees to cooperate with the public agency in the payment of budgeted funds, as is necessary, for on-the-job and/or off-the job programs for outreach and training of minorities and women.

(D) The contractor and its subcontractors shall furnish such reports or other documents to the Dept. of LWD, Construction EEO Monitoring Program as may be requested by the Dept. of LWD, Construction EEO Monitoring Program from time to time in order to carry out the purposes of these regulations, and public agencies shall furnish such information as may be requested by the Dept. of LWD, Construction EEO Monitoring Program for conducting a compliance investigation pursuant to N.J.A.C. 17:27-1.1 et seq.

Each contractor shall submit to the public agency, prior to execution of a public agency contract a completed form AA201:

****The Board of Education recognizes the right of its employees/students to work and study in an environment that is free from sexual harassment. Immediate and appropriate action will be taken against any vendor/agent of the Board found liable for sexually harassing any employee/student.**

Note: Please sign below that you have read and understand the EEO Language. This does not fulfill your obligation to submit the required document prior signing a construction contract.

Company: _____

Authorized Signature: _____

Address _____

_____

_____

NON-COLLUSION AFFIDAVIT

STATE OF NEW JERSEY)

COUNTY OF)

I, of the Municipality of in the County of, and the State of of full age, being duly sworn according to law on my oath depose and say that: I am of the firm of the bidder making this Proposal/Bid for the **Salem County Career and Technical High School 2024 Addition and Renovations,** and that I executed the said Bid with full authority so to do; that said bidder has not, directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free, competitive bidding in connection with the **Salem County Career and Technical High School 2024 Addition and Renovations** and that all statements contained in said Bid and in this affidavit are true and correct, and made with full knowledge that the Owner relies upon the truth of the statements contained in said Bid and in the statements contained in this affidavit in awarding the contract for the said project.

I further warrant that no person or selling agency has been employed or retained to solicit or secure such contract upon an agreement or understanding for a commission, percentage, brokerage or contingent fee, except bona fide employees or bona fide established commercial or selling agencies maintained by

_____
(Name of Bidder)

_____
Bidder's Signature

Sworn to and subscribed before me

this____ day of _____, 20____.

_____
Notary Public of

My Commission expires _____ 20___

C. 271 POLITICAL CONTRIBUTION DISCLOSURE FORM

Contractor Instructions

Pursuant to N.J.S.A. 19:44A-20.26 and N.J.A.C. 6A:23A-6.3, bidder must submit the enclosed form with its bid, disclosing contributions to:

- any continuing political committee (a.k.a., political action committee)
- any candidate committee of a candidate for, or holder of, an elective office:
  - of the public entity awarding the contract
  - of that county in which that public entity is located
  - of another public entity within that county
  - or of a legislative district in which that public entity is located or, when the public entity is a county, of any legislative district which includes all or part of the county

The disclosure must list reportable contributions to any of the committees that exceed $200 per election cycle that were made during the 12 months prior to award of the contract. See N.J.S.A. 19:44A-8 and 19:44A-16 for more details on reportable contributions.

N.J.S.A. 19:44A-20.26 itemizes the parties from whom contributions must be disclosed when a business entity is not a natural person. This includes the following:

- individuals with an "interest" ownership or control of more than 10% of the profits or assets of a business entity or 10% of the stock in the case of a business entity that is a corporation for profit
- all principals, partners, officers, or directors of the business entity or their spouses
- any subsidiaries directly or indirectly controlled by the business entity
- IRS Code Section 527 New Jersey based organizations, directly or indirectly controlled by the business entity and filing as continuing political committees, (PACs).

When the business entity is a natural person, "a contribution by that person's spouse or child, residing therewith, shall be deemed to be a contribution by the business entity." [N.J.S.A. 19:44A-20.26(b)] The contributor must be listed on the disclosure.

Any business entity that fails to comply with the disclosure provisions shall be subject to a fine imposed by ELEC in an amount to be determined by the Commission which may be based upon the amount that the business entity failed to report.

The list of agencies on pages 4 and 5 of this document is provided to assist the bidder in identifying those public agencies whose elected official and/or candidate campaign committees are affected by the disclosure requirement. It is the bidder's responsibility to identify the specific committees to which contributions may have been made and need to be disclosed. The disclosed information may exceed the minimum requirement.

The enclosed form must be provided. The bidder **may not** provide a content-consistent facsimile, or an electronic data file containing the required details. The enclosed form, as submitted, is disclosable to the public under the Open Public Records Act.

C. 271 POLITICAL CONTRIBUTION DISCLOSURE FORM

Required Pursuant To N.J.S.A. 19:44A-20.26

This form must be submitted to the Owner with bidder's bid.

Part I – Vendor Information

Vendor Name:			
Address:			
City:		State:	Zip:

The undersigned being authorized to certify, hereby certifies that the submission provided herein represents compliance with the provisions of N.J.S.A. 19:44A-20.26 including as represented by the Instructions accompanying this form.

Signature	Printed Name	Title

Part II – Contribution Disclosure

Disclosure requirement: Pursuant to N.J.S.A. 19:44A-20.26 this disclosure must include all reportable political contributions (more than $200 per election cycle) over the 12 months prior to submission to the committees of the government entities listed on the form provided by the local unit.

☐ Check here if disclosure is provided in electronic form.

Contributor Name	Recipient Name	Date	Dollar Amount
			$

☐ Check here if the information is continued on subsequent page(s)

Continuation Page

C. 271 POLITICAL CONTRIBUTION DISCLOSURE FORM

Required Pursuant To N.J.S.A. 19:44A-20.26

Page ___ of ______

Vendor Name:

Coutributor Name	Recipient Name	Date	Dollar Amount
			$

☐ Check here if the information is continued on subsequent page(s)

List of Agencies with Elected Officials Required for Political Contribution Disclosure
N.J.S.A. 19:44A-20.26

County Name: Salem

State: Governor, and Legislative Leadership Committees

Legislative District #s: 3

State Senator and two members of the General Assembly per district.

County:

Freeholders County Clerk Sheriff Surrogate

Municipalities (Mayor and members of governing body, regardless of title):

Alloway Township
Carneys Point Township
Elmer Borough
Elsinboro Township
Lower Alloways Creek Township
Mannington Township
Oldmans Township
Penns Grove Borough
Pennsville Township
Pilesgrove Township
Pittsgrove Township
Quinton Township
Salem City
Upper Pittsgrove Township
Woodstown Borough

Boards of Education (Members of the Board):

Alloway Township
Elmer Borough
Elsinboro Township
Lower Alloways Creek
Mannington Township
Oldmans Township
Penns Grove-Carney's Point Regional
Pennsville
Pittsgrove Township
Quinton Township
Salem City
Upper Pittsgrove Township
Woodstown-Pilesgrove Regional

Fire Districts (Board of Fire Commissioners):

Pittsgrove Township Fire District No. 1
Pittsgrove Township Fire District No. 2
Pittsgrove Township Fire District No. 3

Prohibited Russia-Belarus Activities & Iran Investment Activities

Person or Entity	

Part 1: Certification

COMPLETE PART 1 BY CHECKING **ONE OF THE THREE BOXES BELOW**

Pursuant to law, any person or entity that is a successful bidder or proposer, or otherwise proposes to enter into or renew a contract, for goods or services must complete the certifieation below prior to contract award to attest, under penalty of perjury, that neither the person or entity, nor any parent entity, subsidiary, or affiliate, is identified on the Department of Treasury's Russia-Belarus list or Chapter 25 list as a person or entity engaging in prohibited activities in Russia, Belarus or Iran. Before a contract for goods or services can be amended or extended, a person or entity must certify that neither the person or entity, nor any parent entity, subsidiary, or affiliate, is identified on the Department of Treasury's Russia-Belarus list. Both lists are found on Treasury's website at the following web addresses:

https://www.nj.gov/treasury/administration/pdf/RussiaBelarusEntityList.pdf
www.state.nj.us/treasury/purchase/pdf/Chapter25List.pdf.

As applicable to the type of contract, the above-referenced lists must be reviewed prior to completing the below eertification.

A person or entity unable to make the certification must provide a detailed, accurate, and precise description of the activities of the person or entity, or of a parent entity, subsidiary, or affiliate, engaging in prohibited activities in Russia or Belarus and/or investment activities in Iran. The person or entity must cease engaging in any prohibited activities and provide an updated certification before the contract ean be entered into.

If a vendor or contractor is found to be in violation of law, action may be taken as appropriate and as may be provided by law, rule, or contract, including but not limited to imposing sanctions, seeking compliance, recovering damages, declaring the party in default, and seeking debarment or suspension of the party.

CONTRACT AWARDS AND RENEWALS

☐	*I certify, pursuant to law, that neither the person or entity listed above, nor any parent entity, subsidiary, or affiliate appears on the N.J. Department of Treasury's lists of entities engaged in prohibited activities in Russia or Belarus pursuant to P.L. 2022, c. 3 or in investment activities in Iran pursuant to P.L. 2012, c. 25 ("Chapter 25 List"). I further certify that I am the person listed above, or I am an officer or representative of the entity listed above and am authorized to make this certification on its behalf.* (Skip Part 2 and sign and complete the Certification below.)

CONTRACT AMENDMENTS AND EXTENSIONS	
☐	*I certify, pursuant to law, that neither the person or entity listed above, nor any parent entity, subsidiary, or affiliate is listed on the N.J. Department of the Treasury's lists of entities determined to be engaged in prohibited activities in Russia or Belarus pursuant to P.L. 2022, c. 3. I further certify that I am the person listed above, or I am an officer or representative of the entity listed above and am authorized to make this certification on its behalf.* (Skip Part 2 and sign and complete the Certification below.)
IF UNABLE TO CERTIFY	
☐	*I am unable to certify as above because the person or entity and/or a parent entity, subsidiary, or affiliate is listed on the Department's Russia-Belarus list and/or Chapter 25 Iran list. I will provide a detailed, accurate, and precise description of the activities as directed in Part 2 below, and sign and complete the Certification below. Failure to provide such will prevent the award of the contract to the person or entity, and appropriate penalties, fines, and/or sanctions will be assessed as provided by law.*

Part 2: Additional Information

PLEASE PROVIDE FURTHER INFORMATION RELATED TO PROHIBITED ACTIVITIES IN RUSSIA OR BELARUS AND/OR INVESTMENT ACTIVITIES IN IRAN.

You must provide a detailed, accurate, and precise description of the activities of the person or entity, or of a parent entity, subsidiary, or affiliate, engaging in prohibited activities in Russia or Belarus and/or investment activities in Iran in the space below and, if needed, on additional sheets provided by you.

Part 3: Certification of True and Complete Information

I, being duly sworn upon my oath, hereby represent and state that the foregoing information and any attachments there, to the best of my knowledge, are true and complete. I attest that I am authorized to execute this certification on behalf of the above-referenced person or entity.

I acknowledge that the Board of Education for SSSD and VTSD of the County of Salem is relying on the information contained herein and hereby acknowledge that I am under a continuing obligation from the date of this certification through the completion of any contracts with the Board of Education for SSSD and VTSD of the County of Salem to notify the Board of Education for SSSD and VTSD of the County of Salem in writing of any changes to the answers of information contained herein.

I acknowledge that I am aware that it is a criminal offense to make a false statement or misrepresentation in this certification. If I do so, I recognize that I am subject to criminal prosecution under the law and that it will also constitute a material breach of my agreement(s) with the Board of Education for SSSD and VTSD of the County of Salem and that the Board of Education for SSSD and VTSD of the County of Salem at its option may declare any contract(s) resulting from this certification void and unenforceable.

Full Name (Print)		**Title**	
Signature		**Date**	

EQUIPMENT CERTIFICATION

In accordance with 18A:18A-23, The undersigned bidder hereby certifies as follows:

The bidder owns, leases or controls all necessary equipment required to accomplish the work described in the Contract Documents.

Name of Bidder: _____

Signature: _____

Name of Signor: _____

Title: _____

Date: _____

If the bidder is not the actual owner or lessee of such equipment, bidder shall provide the source(s) of such equipment and provide certifications from the owners or other persons controlling such equipment definitely granting to the bidder the control of the equipment required during such times as may be necessary for the completion of that portion of the contract for which that equipment is necessary.

Equipment Source(s):
(if any necessary equipment not owned or leased)

_____
(entity name and physical address)

_____
(entity name and physical address)

_____
(entity name and physical address)

Add additional sheets if necessary for additional sources

Attach Required Certifications for Each Source
(if any necessary equipment not owned or leased)

AMERICANS WITH DISABILITIES ACT OF 1990
Equal Opportunity for Individuals with Disability

The Contractor and the Board of Education for SSSD and VTSD of the County of Salem, (hereafter "owner") do hereby agree that the provisions of Title 11 of the Americans With Disabilities Act of 1990 (the "Act") (42 U.S.C. S12101 et seq.), which prohibits discrimination on the basis of disability by public entities in all services, programs, and activities provided or made available by public entities, and the rules and regulations promulgated pursuant there unto, are made a part of this contract. In providing any aid, benefit, or service on behalf of the owner pursuant to this contract, the contractor agrees that the performance shall be in strict compliance with the Act. In the event that the contractor, its agents, servants, employees, or subcontractors violate or are alleged to have violated the Act during the performance of this contract, the contractor shall defend the owner in any action or administrative proceeding commenced pursuant to the Act. The contractor shall indemnify, protect, and save harmless the owner, its agents, servants, and employees from and against any all suits, claims, losses, demands, or damages, of whatever kind or nature arising out of or claimed to arise out of the alleged violation. The contractor shall, at its own expense, appear, defend, and pay any and all charges for legal services and any and all costs and other expenses arising from such action or administrative proceeding or incurred in connection therewith. In any and all complaints brought pursuant to the owner's grievance procedure, the contractor agrees to abide by any decision of the owner which is rendered pursuant to said grievance procedure. If any action or administrative proceeding results in an award of damages against the owner, of if the owner incurs any expense to cure a violation of the ADA which has been brought pursuant to its grievance procedure, the contractor shall satisfy and discharge the same at its own expense.

The owner shall, as soon as practicable after a claim has been made against it, give written notice thereof to the contractor along with particulars of the claim then known by the owner. If any action or administrative proceeding is brought against the owner or any of its agents, servants, and employees, the owner shall expeditiously forward or have forwarded to the contractor every demand, complaint, notice, summons, pleading, or other process received by the owner or its representatives.

It is expressly agreed and understood that any approval by the owner of the services provided by the contractor pursuant to this contract, or an independent violation by the owner, will not relieve the contractor of the obligation to comply with the Act and to defend, indemnify, protect, and save harmless the owner pursuant to this paragraph.

It is further agreed and understood that the owner assumes no obligation to indemnify or save harmless the contractor, its agents, servants, employees and subcontractors for any claim which may arise out of their performance of this Agreement. Furthermore, the contractor expressly understands and agrees that the provisions of this indemnification clause shall in no way limit the contractor's obligations assumed in this Agreement, nor shall they be construed to relieve the contractor from any liability, nor preclude the owner from taking any other action's available to it under any other provisions of the Agreement or otherwise at law.

PERFORMANCE AND PAYMENT BOND

Bond No. _____[Principal]_____

KNOW ALL MEN BY THESE PRESENTS, that we, _____,
as Principal, and _____,
a corporation duly authorized to do business in the State of New Jersey, as Surety (the "Surety"), are hereby held and firmly bound unto

The Board of Education of the
Special Services School District and the Vocational Technical School District of the County of Salem
880 Route 45
Woodstown, NJ 08098

(hereinafter called the "Obligee") in the penal sum of _____[100% of the Contract Amount]
Dollars, ($_____),
for the payment of which will and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

Signed this_____day of_____, 20____.

THE CONDITION OF THE ABOVE OBLIGATION IS SUCH, THAT WHEREAS, the above named Principal did, on the_____day of_____ , 20____, enter into a Contract with the Obligee for the **Salem County Career and Technical High School 2024 Addition and Renovations;** which said Contract is made a part of this, the Bond, the same as though set forth herein:

NOW THEREFORE, if the said _____[Principal]_____
shall well and faithfully do and perform the things agreed by [Principal] _____[Principal]_____
to be done and performed in accordance to the terms of said Contract, and shall pay all lawful claims of subcontractors, materialmen, laborers, persons, firms or corporations for labor performed or materials, provisions or other supplied, fuels, oils, implements, or machinery furnished, used or consumed in the carrying forward, performing or completing of said Contract as required by N.J.S.A. 2A:44-143, we agreeing and assenting that this undertaking shall be for the benefit of any subcontractors, materialmen, laborers, persons, firms or corporations having a just claim as required by N.J.S.A. 2A:44-143, as well as for the Obligee herein, then this obligation shall be void; otherwise, the same shall remain in full force and effect; it being expressly understood and agreed that the liability of the Surety for any and all claims hereunder shall in no event exceed the penal amount of this obligation as herein stated.

THE SAID SURETY hereby stipulates and agrees that no modifications, omissions or additions in or to the terms of the said Contract or in or to the Drawings or Specifications therefor shall in any way affect the obligation of said Surety on its Bond.

PERFORMANCE AND PAYMENT BOND

THIS BOND is given in compliance with the requirements of the statutes of the State of New Jersey in respect to bonds of contractors on public works (including N.J.S.A. 2A:44-143 et seq.) and liability hereunder is as limited and expansive as said statutes provide.

Signed and Sealed this _____ day of _____, 20__.

_____
Principal Name

Witness:

_____ By: _____
As to Principal Principal Signature [SEAL]

_____
Surety Name

_____ By: _____
As to Surety Surety Signature [SEAL]

MAINTENANCE BOND

Bond No. _____ [Principal]_____

KNOW ALL MEN BY THESE PRESENTS, that we, _____,
as Principal, and _____,
a corporation duly authorized to do business in the State of New Jersey, as Surety (the "Surety"), are hereby held and firmly bound unto

The Board of Education of the
Special Services School District and the Vocational Technical School District of the
County of Salem
880 Route 45
Woodstown, NJ 08098

(hereinafter called the "Obligee") in the penal sum of___[100% of the Contract Amount]_____Dollars,
($_____),
for the payment of which will and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns.

Signed this_____day of_____, 20____.

THE CONDITION OF THE ABOVE OBLIGATION IS SUCH, THAT WHEREAS, the above named Principal did, on the_____day of_____ , 20____, enter into a Contract with the Obligee for **the Salem County Career and Technical High School 2024 Addition and Renovations**; which said Contract is made a part of this, the Bond, the same as though set forth herein:

NOW THEREFORE, if the said _____[Principal]_____ shall remedy without cost to the Obligee any defects which may develop during the two (2) year Maintenance Period of the work performed under the said Contract, provided such defects, in the judgment of the Obligee are caused by defective or inferior materials or workmanship, then this obligation shall be void, otherwise it shall be and remain in full force and effect. The two (2) year period shall commence on the date established by Obligee's final acceptance of the Principal's Work.

The said Surety hereby stipulates and agrees that no modifications, deletions or additions in or to the terms of the said Contract or the plans or specifications therefor shall in any way affect its obligations on this bond.

[LEFT INTENTIONALLY BLANK]

Signed and Sealed this _____ day of _____, 20__.

_____
Principal Name

Witness:

_____ By: _____
As to Principal Principal Signature [SEAL]

_____
Surety Name

_____ By: _____
As to Surety Surety Signature [SEAL]

STATE OF NEW JERSEY

DEPARTMENT OF LABOR & WORKFORCE DEVELOPMENT
CONSTRUCTION EEO COMPLIANCE MONITORING PROGRAM

FORM AA-201
Revised 11/11

INITIAL PROJECT WORKFORCE REPORT CONSTRUCTION

Official Use Only

Assignment

Code

For instructions on completing the form, go to: http://www.state.nj.us/treasury/contract_compliance/pdf/aa201ins.pdf

1. FID NUMBER

2. CONTRACTOR ID NUMBER

3. NAME AND ADDRESS OF PRIME CONTRACTOR

(Name)

(Street Address)

(City) (State) (Zip Code)

4. IS THIS COMPANY MINORITY OWNED [ ] OR WOMAN OWNED [ ]

5. NAME AND ADDRESS OF PUBLIC AGENCY AWARDING CONTRACT
Name:
Address:

CONTRACT NUMBER DATE OF AWARD DOLLAR AMOUNT OF AWARD

6. NAME AND ADDRESS OF PROJECT
Name:
Address:

COUNTY

7. PROJECT NUMBER

8. IS THIS PROJECT COVERED BY A PROJEC
LABOR AGREEMENT (PLA)? YES

9. TRADE OR CRAFT	PROJECTED TOTAL EMPLOYEES				PROJECTED MINORITY EMPLOYEES				PROJECTED PHASE - IN DATE	PROJECTED COMPLETION DATE
	MALE		FEMALE		MALE		FEMALE			
	J	AP	J	AP	J	AP	J	AP		
1. ASBESTOS WORKER										
2. BRICKLAYER OR MASON										
3. CARPENTER										
4. ELECTRICIAN										
5. GLAZIER										
6. HVAC MECHANIC										
7. IRONWORKER										
8. OPERATING ENGINEER										
9. PAINTER										
10. PLUMBER										
11. ROOFER										
12. SHEET METAL WORKER										
13. SPRINKLER FITTER										
14. STEAMFITTER										
15. SURVEYOR										
16. TILER										
17. TRUCK DRIVER										
18. LABORER										
19. OTHER										
20. OTHER										

I hereby certify that the foregoing statements made by me are true. I am aware that if any of the foregoing statements are willfully
false, I am subject to punishment.

(Signature)

10. (Please Print Your Name) (Title)

(Area Code) (Telephone Number) (Ext.) (Date)

INSTRUCTIONS FOR COMPLETING THE INITIAL PROJECT
WORKFORCE REPORT – CONSTRUCTION (AA201)

DO NOT COMPLETE THIS FORM FOR GOODS AND/OR SERVICE CONTRACTS

1. Enter the Federal Identification Number assigned to the contractor by the Internal Revenue Service, or if a Federal Employer Identification Number has been applied for but not yet issued, or if your business is such that you have not or will not receive a Federal Identification Number, enter the social security number assigned to the single owner or one partner, in the case of a partnership.

2. Note: The Department of Labor & Workforce Development, Construction EEO Monitoring Program will assign a contractor ID number to your company. This number will be your permanently assigned contractor ID number that must be on all correspondence and reports submitted to this office.

3. Enter the prime contractor's name, address and zip code number.

4. Check box if Company is Minority Owned or Woman Owned

5. Enter the complete name and address of the Public Agency awarding the contract. Include the contract number, date of award and dollar amount of the contract.

6. Enter the name and address of the project, including the county in which the project is located.

7. Note: A project contract ID number will be assigned to your firm upon receipt of the completed Initial Project Workforce Report (AA201) for this contract. This number must be indicated on all correspondence and reports submitted to this office relating to this contract.

8. Check "Yes" or "No" to indicate whether a Project Labor Agreement (PLA) was established with the labor organization(s) for this project.

9. Under the Projected Total Number of Employees in each trade or craft and at each level of classification, enter the total composite workforce of the prime contractor and all subcontractors projected to work on the project. Under Projected Employees enter total minority and female employees of the prime contractor and all subcontractors projected to work on the project. Minority employees include Black, Hispanic, American Indian and Asian, (J=Journeyworker, AP=Apprentice). Include projected phase-in and completion dates.

10. Print or type the name of the company official or authorized Equal Employment Opportunity (EEO) official include signature and title, phone number and date the report is submitted.

This report must be submitted to the Public Agency that awards the contract and the Department of Labor & Workforce Development, Construction EEO Compliance Monitoring Program after notification of award, but prior signing the contract.

THE CONTRACTOR IS TO RETAIN A COPY AND SUBMIT COPY TO THE PUBLIC AGENCY AWARDING THE CONTRACT AND FORWARD A COPY TO:

NEW JERSEY DEPARTMENT OF LABOR & WORKFORCE DEVELOPMENT
CONSTRUCTION EEO COMPLIANCE MONITORING UNIT
P.O. BOX 209
TRENTON, NJ 08625-0209
(609) 292-9550

DRAFT

AIA® Document A101™ - 2017

Standard Form of Agreement Between Owner and Contractor
where the basis of payment is a Stipulated Sum

AGREEMENT made as of **the 00** day of **MONTH in** the year Two Thousand Twenty-Three
(In words, indicate day, month and year.)

BETWEEN the Owner:
(Name, legal status, address and other information)

The Board of Education of the Special Services School District and
the Vocational Technical School District of
the County of Salem
880 Route 45
Woodstown, NJ 08098

and the Contractor:
(Name, legal status, address and other information)

NAME OF CONTRACTOR
ADDRESS OF CONTRACTOR
CITY, STATE ZIP

for the following Project:
(Name, location and detailed description)

Salem County Career and Technical High School
2024 Addition and Renovations 880 Route 45
Woodstown, New Jersey 08098

The Architect:
(Name, legal status, address and other information)

Garrison Architects
713 Creek Road
Bellmawr, New Jersey 08031

The Construction Manager:

TBD

The Owner and Contractor agree as follows.

ADDITIONS AND DELETIONS: The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

The parties should complete A101™-2017, Exhibit A, Insurance and Bonds, contemporaneously with this Agreement. AIA Document A201™-2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

ELECTRONIC COPYING of any portion of this AIA® Document to another electronic file is prohibited and constitutes a violation of copyright laws as set forth in the footer of this document.

TABLE OF ARTICLES

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary, and other Conditions, as amended by the Owner), Drawings, Specifications and all documents referenced in the Index to the Specifications (including documents submitted with the Contractor's bid unless otherwise noted), Addenda issued prior to execution of this Agreement, all documents referenced by other documents listed in this Agreement, and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9. In the event of any conflict or inconsistency between any of the Contract Documents, the interpretation most favorable to the Owner and/or which imposes upon Contractor a greater obligation shall control.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully and satisfactorily execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be:
(Check one of the following boxes.)

[X] The date of this Agreement

[« »] A date set forth in a notice to proceed issued by the Owner.

[« »] Established as follows:
(Insert a date or a means to determine the date of commencement of the Work.)

§ 3.2 The Contract Time shall be measured from the date of commencement of the Work.

§ 3.3 Substantial Completion

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work:
(Check one of the following boxes and complete the necessary information.)

[« »] Not later than « » (« ») calendar days from the date of commencement of the Work.

[X] By the following date: **August 23, 2024 – TIME IS OF THE ESSENCE**

§ 3.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work are to be completed prior to Substantial Completion of the entire Work, the Contractor shall achieve Substantial Completion of such portions by the following dates: **NOT APPLICABLE**

§ 3.3.3 If the Contractor fails to achieve Substantial Completion as provided in this Section 3.3, liquidated damages, if any, shall be assessed as set forth in Section 4.5. These sums shall constitute liquidated damages, not a penalty.

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be Dollars ($), subject to additions and deductions as provided in the Contract Documents.

§ 4.2 Alternates NOT APPLICABLE

§ 4.2.1 Alternates described in the Contractor's submitted Bid Form and accepted by Owner at the time of award, if any, are included in the Contract Sum.

§ 4.2.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement. **NOT APPLICABLE**

§ 4.3 Allowances, if any, included in the Contract Sum:
(Identify each allowance.)

Item	Price
A. CASH ALLOWANCE	$100,000.00

§ 4.4 Unit prices, if any:

Unit prices are as described in the Contractor's submitted Bid Form.

§ 4.5 Liquidated damages, if any:

(Insert terms and conditions for liquidated damages, if any.)

The Contractor understands and agrees that all work must be performed in an orderly and closely coordinated sequence so that the dates for Substantial Completion and Final Completion are met. TIME IS OF THE ESSENCE.

If the Contractor fails to complete his work or fails to complete a portion of his work and therefore not achieve Substantial Completion and/or Final Completion on the respective dates required, he shall pay the Owner, as liquidated damages and not as a penalty, Two Thousand Five Hundred Dollars ($2,500.00) per day, which is agreed upon as a reasonable and proper measure which the Owner will sustain each calendar day by failure of the Contractor to complete work within the stipulated time for the milestone dates.

The Owner will suffer significant financial loss if the project is not substantially complete on time. Liquidated Damages will be assessed if the Project is not substantially complete by the date required by the Contract Documents. The Contractor (and the Contractor's Surety) shall be liable for and pay to the Owner the sum of $2,500.00 stipulated and fixed, agreed as liquidated damages for each calendar day of delay until the work is substantially complete.

Final Completion must be reached Thirty (30) days following the date fixed in the contract for Substantial Completion. The Contractor (and the Contractor's Surety) shall be liable for and pay to the Owner the sum of $2,500.00 stipulated and fixed, agreed as liquidated damages for each calendar day of delay until the work is finally complete.

Substantial Completion will be determined by the Architect as defined in paragraph 9.8.1 of the General Conditions.

For damage occurring at the time of delay, the Owner may retain the amount due to him under this clause and as liquidated damages from any payments due to the Contractor.

§ 4.6 Other:
(Insert provisions for bonus or other incentives, if any, that might result in a change to the Contract Sum.)

« N/A»

ARTICLE 5 PAYMENTS

§ 5.1 PROGRESS PAYMENTS

§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents. An application for Payment shall include all work performed in one calendar month.

§ 5.1.2 Contractor shall submit a Pencil Copy / Rough Draft of the Application for Payment to the Architect and Construction Manager for review no later than the 15 calendar days prior to the first Friday of the month payment is requested from Owner.

Architect and Construction Manager will review the Pencil Copy / Rough Draft of the Application for Payment and return to the Contractor within five (5) calendar days from their receipt of same.

§ 5.1.3 Certified Application for Payment.

.1. Within three (3) calendar days after receipt of the Pencil / Rough Draft of the Application for Payment from the Architect, the Contractor shall submit five (5) Certified Applications for Payment consistent with the Architect's markup on the Pencil / Rough Draft to the Architect for signatures, unless submitted electronically, in which case only one copy is required.

.2. The Architect shall, if finding payment for the amount submitted is appropriate under the Contract Documents, sign the Certified Application for Payment within five (5) calendar days upon receipt and transmit four (4) Certified Applications for Payment to the Construction Manager (unless submitted electronically, in which case only one copy is required) by Tuesday (3 calendar days) before the first Friday of the month payment is requested from Owner. The Architect shall retain one (1) Certified Application for Payment for its records.

.3 The Construction Manager shall transmit two (2) Certified Applications for Payment to Owner on the first Friday of the month payment is requested. The Construction Manager shall transmit one (1) Certified Application for Payment to the Contractor and retain one (1) Certified Application for Payment for its records unless submitted electronically, in which case only one copy is required. (Federal, state or local laws may require payment within a certain period of time.)

§ 5.1.3.1 The form for Applications for Payment shall be a notarized AIA Document G702, Application and Certification for Payment, supported by AIA document G703 Continuation Sheets. Each Application for Payment must be accompanied by three (3) sets of Certified Payroll Records for the period covered by the Application. The payroll records shall indicate the proper classification of employees and the payment of overtime, if any. These records shall include certified payrolls for each of Contractor's subcontractors of any tier. Payment will not be authorized if the required payroll records have not been submitted.

§ 5.1.3.2 All Applications for Payment, Certified Payroll Records and Manning Reports shall include the relevant purchase order number and project number.

§ 5.1.3.3 Pursuant to N.J.S.A. 2A:30A-1, et seq. (the "Act"), the Owner is not required to approve the Contractor's Application for Payment unless the Contractor has performed in accordance with the Contract Documents and is not required to provide approval until the next scheduled public meeting of the Board of Education following the Owner's receipt of the Architect's Certificate for Payment. Under the Act, the Owner shall not make payment to the Contractor for the payment amount until the Owner's subsequent payment cycle following its approval of the Application for Payment.

§ 5.1.3.4 Interest on amounts due pursuant to the Act shall be paid to the prime Contractor for the period beginning on the day after the required payment date and ending on the day on which the check for payment is received by the Contractor.

§ 5.1.3.5 Disputes regarding whether the Owner has failed to make payments required by the Act must be submitted to mediation unless the Owner and Contractor waive such requirement in writing at the time the dispute arises, notwithstanding anything to the contrary in the Contract Documents. The Owner and Contractor shall make a good faith effort to agree on a mediator. If the Owner and Contractor are unable to agree on a mediator, the Owner and Contractor shall each select a neutral performing service in the State of New Jersey and such neutrals shall in turn select the mediator. Owner and Contractor shall each be responsible for their own mediation costs, including one-half of the mediator's compensation, which shall be subject to an alternate allocation at the mediation. Such mediation shall apply to disputes over payments asserted to be required from Owner under the Act only and shall not apply to disputes concerning any other matters that may arise under, from or in relation to this Contract or Project. Any civil action arising under, from or in relation to this Contract or Project shall be conducted in the Superior Court for the State of New Jersey and venued in Salem County, New Jersey.

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work, including those items referenced in Section 9.2.2 of AIA Document A201™–2017, General Conditions of the Contract for Construction as modified (the "A201"). The schedule of values shall be prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect promptly, shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.6 In accordance with the A201, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.1.6.1 The amount of each progress payment shall first include:

.1 That portion of the Contract Sum properly allocable to completed Work;

.2 That portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing; and

.3 That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified.

§ 5.1.6.2 The amount of each progress payment shall then be reduced by:

.1 The aggregate of any amounts previously paid by the Owner;
.2 The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of the A201;
.3 Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;
.4 For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of the A201; and
.5 Retainage withheld pursuant to Section 5.1.7.

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due:
(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)

Pursuant to N.J.S.A. 18A:18A-40.3, the Owner will withhold two percent (2%) of the amount due on each partial payment when the outstanding balance of the Contract exceeds Five Hundred Thousand Dollars ($500,000.00), and the Owner will withhold five percent (5%) of the amount due on each partial payment when the outstanding balance of the Contract is Five Hundred Thousand Dollars ($500,000.00) or less. Retainage shall be withheld until the Owner approves the Architect's determination that the work has been satisfactorily and finally completed and no unsettled claims exist.

§ 5.1.7.1.1 The following items are not subject to retainage: **NOT APPLICABLE**
(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)

§ 5.1.7.2 Reduction or limitation of retainage, if any, shall be as follows:
(If the retainage established in Section 5.1.7.1 is to be modified prior to Substantial Completion of the entire Work, including modifications for Substantial Completion of portions of the Work as provided in Section 3.3.2, insert provisions for such modifications.)

« »

§ 5.1.7.3 Except as set forth in this Section 5.1.7.3, upon Final Completion of the Work, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7.
(Insert any other conditions for release of retainage upon Substantial Completion.)

« »

§ 5.1.8 If final completion of the Work is materially delayed through no fault of the Contractor, the Owner shall pay the Contractor any additional amounts in accordance with the A201.

§ 5.1.9 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.2 Final Payment

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

.1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Article 12 of the A201, and to satisfy other requirements, if any, which extend beyond final payment; and
.2 a final Certificate for Payment has been issued by the Architect.

§ 5.2.2 The Owner's final payment to the Contractor shall be made as follows:

« Final payment shall be approved, if appropriate, at the next scheduled public meeting of the School Board following the provision to Owner of Architect's final Certificate of Payment. Final payment after approval shall be made during the School Board's subsequent payment cycle. »

§ 5.3 Interest

Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.
(Insert rate of interest agreed upon, if any.)

Zero percent (0%) except to the extent and in the amount required by N.J.S.A. 2A:30A-2(c) as to any particular payment.

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Initial Decision Maker

The Architect will serve as the Initial Decision Maker pursuant to Article 15 of the A201, unless the parties appoint below another individual, not a party to this Agreement, to serve as the Initial Decision Maker.
(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

« »
« »
« »
« »

§ 6.2 Binding Dispute Resolution

The method of binding dispute resolution for disputes arising out of, under or relating to this Contract or the Project shall be as follows:
(Check the appropriate box.)

[« »] Arbitration pursuant to Section 15.4 of AIA Document A201–2017

[X] Litigation in Superior Court of New Jersey in Salem County. New Jersey law shall apply to all disputes arising out of, under or relating to this Contract or the Project without respect to the conflict of law principles thereof.

[« »] Other *(Specify)*

ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of the A201.

§ 7.1.1 If the Contract is terminated for the Owner's convenience in accordance with the A201, then the Owner shall, after the Site and Work are secured and protected, pay the Contractor a termination fee as follows:
(Insert the amount of, or method for determining, the fee, if any, payable to the Contractor following a termination for the Owner's convenience.)

« The amount due Contractor for the Work performed through the date of termination as dictated by the schedule of values, retainage on such amounts, and such amounts as are reasonably necessary to secure and protect the Site and the Work. This shall be Contractor's sole compensation for termination for convenience by Owner. Timing of the payment shall be in the same manner as Final Payment under Article 5. No other payment of any kind, whatsoever, shall be due from the Owner.

Under no circumstances shall Contractor be entitled to any other compensation or termination fee where Owner has terminated for convenience whether for work contemplated but not performed or for any other reason, cause, or expense.»

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of the A201.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of the A201 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 The Owner's representative:

(Name, address, email address, and other information)

Jennifer K. Bates, Ed.D. Assistant Superintendent / Business Administrator
The Board of Education of the Special Services School District and the Vocational Technical School District of the County of Salem
880 Route 45
Woodstown, NJ 08098

§ 8.3 The Contractor's representative:
(Name, address, email address, and other information)

§ 8.4 Neither the Owner's nor the Contractor's representative shall be changed without ten days' prior notice to the other party.

§ 8.5 Insurance and Bonds

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in the A201 and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in the A201 and elsewhere in the Contract Documents.

§ 8.6 Notice in electronic format may be given in accordance with the below:

« Subject to the limitations set forth in the A201 (specifically Section 1.6 thereof), notice may be given electronically to (i) the Owner, Architect or Construction Manager by the Contractor via email to: the email address for Owner's Representative in Section 8.2; the email address provided by Construction Manager following the award of the project to Contractor; and the email addressed provided by Architect following the award of the project to Contractor; and (ii) the Contractor by Owner, Architect, or Construction Manager via email to: the email address for Contractor's Representative in Section 8.3.

§ 8.7 Other provisions:

1. Payments due and unpaid under the Contract shall in no instance bear interest, except as required by law pursuant to Section 5.1.3.4 and 5.3 of this Agreement.

2. The contractor shall ensure that the Project Site is maintained in a clean and safe condition at all times. If the contractor fails to keep the Project Site in a clean and safe condition, said failure shall result in the following:

   a. All claims resulting from the Contractor's failure shall be the Contractor's sole responsibility and Contractor shall defend, indemnify and hold Owner harmless therefrom.;
   b. Said failure shall constitute an act of default and a substantial breach of the Contract giving the Owner remedies under the Contract Documents; and
   c. The Owner shall have the right to withhold any payments until the Contractor cures its failure.

   Failure to cure shall authorize the Owner to withhold any Certifications for Payment until such time as the Contractor has rectified same. Further, if the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so, and the cost thereof plus a 15% administrative fee shall be charged to the Contractor.

3. The within contract shall be governed by and interpreted pursuant to the laws of the State of New Jersey without respect to the conflict of law principles thereof.

4. The Contractor shall comply with the anti-discrimination provisions of N.J.S.A. 10:2-1, et seq., the New Jersey Law Against Discrimination, N.J.S.A. 10:5-1, et seq., and all provisions regarding equal employment opportunity, N.J.S.A. 10:5-31, et seq., N.J.A.C. 17:27-1.1, and N.J.A.C. 6A:7-1.8. The Owner and the Contractor guaranty to afford equal opportunity in the performance of this Contract in accordance with an affirmative action program approved by the State Treasurer and shall provide the documents required for this Project.

5. To perform the services provided for herein, the Contractor and its Prime Subcontractors shall be prequalified/classified by the New Jersey Department of Treasury, Division of Property, Management and Construction. The failure to possess or obtain such classifications shall result in the immediate termination of this Agreement.

6. The Contractor represents that, to the best of its knowledge, information and belief, none of its employees in engaged in conduct that constitutes a conflict of interest under, or a violation of, the School Ethics Act, N.J.S.A. 18A:12-21, et seq., and N.J.A.C. 6A:28-1.1, et seq.

7. Before final payment on the contract is made by Owner, the Contractor shall submit an accurate list and the proof of business registration in the State of New Jersey of each subcontractor or supplier used in the fulfillment of the contract or shall attest that no subcontractors were used.

8. For the term of the Agreement, the Contractor, any subcontractor and each of their affiliates, so designated pursuant to N.J.S.A. 52:32-44(g)(3), shall collect and remit to the New Jersey Director of the Division of Taxation in the Department of Treasury, the use tax due pursuant to the Sales and Use Tax Act, N.J.S.A. 52:32B-1, et seq., on all of their sales of tangible personal property delivered into the State of New Jersey, regardless of whether the tangible personal property is intended for a contract with a contracting agency. For purposes of this paragraph, "affiliate" shall mean any entity that: (a) directly, indirectly or constructively controls another entity; (b) is directly, indirectly or constructively controlled by another entity; or, (c) is subject to the control of a common entity. For purposes of the immediately preceding sentence, an entity controls another entity if it owns, directly or indirectly, more than fifty percent (50%) of the ownership interest of that entity.

9. It is the obligation of the Contractor to provide a full and complete copy of all insurance policies held by it at the Contractor's sole expense, upon reasonable request by the Owner, in the amounts specified in the Bid Documents (see Article 11 of the A201). The Contractor's failure to obtain or maintain adequate insurance coverage shall result in the immediate termination of this Agreement. The Owner will have the right to request copies of the Contractor's insurance policies or any part thereof including Certificates of Insurance evidencing the coverage in place for the duration of the contract period.

10. This Agreement and the General Conditions of the Contract as modified or supplemented in writing, shall control in the case of conflict between these documents and the Project Specifications, the Project Manual and any other exhibits incorporated by reference into this Agreement in Article 9 herein.

11. In claims against any person or entity indemnified under this Agreement by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under this Agreement shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

12. Contracts between the Contractor and Subcontractors shall (1) require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by the terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety and protection of the Subcontractor's Work, which the Contractor, by the Contract Documents, assumes toward the Owner and its consultants.

13. Unpaid Lien Balance

a. To the fullest extent permitted by law, the Contractor shall not suffer or permit any Construction Lien (including a Construction Lien, lis pendens, or other encumbrance or cloud on title), Notice of Unpaid Balance and Right to File Lien ("NUB'') or Municipal Mechanics' Lien to be filed or to remain of record as a claim against the Work or the Project or against any monies due or to become due for any work performed or services, materials or equipment furnished by to or on behalf of Contractor or any of its Subcontractors or Sub-subcontractors or any suppliers to Contractor or its Subcontractors ("Suppliers"), nor shall Contractor suffer or permit any such Construction Lien or NUB to be so filed because of any claim or demand against, or any action or non-action of the Contractor or any Subcontractors, Sub-subcontractors or Suppliers.

b. In the event that any such Subcontractor, Sub-subcontractor or Supplier or any other party with whom the Contractor has entered into a relationship to perform any portion of the Work, files a Construction Lien and/or NUB arising out of or in connection with the Work or any work, services, material or equipment associated with this Agreement (and, as to a Municipal Mechanics' Lien, provided that Owner is not then in breach of its monetary obligation to Contractor for the work, services, material or equipment which is the subject of the Municipal Mechanics' Lien under the Contract Documents), Contractor shall within ten (10) days of receipt of notice of said Construction Lien, NUB or Municipal Mechanics' Lien cause same to be discharged, satisfied and/or bonded and, in default thereof, Owner shall have the right to bond said Construction Lien, NUB or Municipal Mechanics' Lien or otherwise discharge same (provided that Owner shall only pay and satisfy any Construction Lien, NUB or Municipal Mechanics' Lien if, within twenty (20) days from the earlier of (a) service of the lien claim on Contractor or (b) written notice from the Owner to Contractor or Subcontractor (where applicable), Contractor or Subcontractor (where applicable) has not notified Owner in writing that the claimant is not owed the monies claimed and the reason therefor, and, to retain out of any payment then due or thereafter to become due to Contractor 110% of the amount of such lien). Nothing in this paragraph shall reduce or limit the Contractor's obligation to eliminate Construction Liens, NUBs or Municipal Mechanics' liens as provided elsewhere in this Paragraph 12.

c. Should a Construction Lien, NUB and/or Municipal Mechanics' Lien be filed by a Subcontractor or Supplier of any tier or any entity or person with whom the Contractor has entered into a relationship to perform any portion of the Work (or any additional or extra work after all payments have been made to Contractor under this Agreement), and should Contractor fail to abide by the terms of this Section, Contractor shall refund to Owner all monies that the latter may be compelled to pay to bond, discharge and/or defend the Construction Lien, NUB and/or Municipal Mechanics' Lien. Any such Construction Lien and/or NUB, until satisfied, bonded off or discharged or withdrawn, shall preclude any and all claim or demand for payment whatsoever by the Contractor. The Contractor further agrees to indemnify, defend, protect and save harmless Owner and the Indemnitees from and against any and all claims, actions, fines and penalties brought or imposed or judgments rendered thereon, or any loss, damages, liability, costs and expenses, including legal fees and disbursements, which Owner may sustain or incur as a consequence of the Contractor's failure to comply with the terms of this Section. The failure of the Contractor to satisfy, discharge and/or bond a Construction Lien and/or NUB filed by a Subcontractor, Sub-subcontractor or Supplier within twenty (20) days of notice thereof shall constitute a material breach of the Contract by the Contractor.

14. In the event the Contractor fails or refuses to discharge any NUB, Construction Lien, Municipal Mechanics' Lien, (for a Municipal Mechanics' Lien, as to work for which the Contractor has been paid) within the timeframe and in the manner set forth in this Section, the Contractor shall be liable to the Owner and Indemnities for the full amount of the Municipal Mechanics' Lien, NUB or Construction Lien and all direct damages sustained by the Owner as a result thereof, as well as, all attorneys' fees and costs incurred by the Owner or any Indemnitee in connection therewith. In such event, in addition to the Owner's right to recover the foregoing damages, attorneys' fees and costs from the Contractor and in addition to all of its other common law and statutory rights, the Owner shall be entitled to: (a) declare a material breach of the Contract and terminate the Contract for default pursuant to Section 14 of the A201 and withhold payment to Contractor; (b) withhold an amount from the Contractor equal to 110 percent of the amount claimed in the NUB, Construction Lien or Municipal Mechanics' lien (c) pay the amount set forth in the NUB, Construction Lien or Municipal Mechanics' Lien and deduct this amount from amounts otherwise owed to the Contractor under the Contract; and/or (d) obtain a discharge of the NUB, Construction Lien or Municipal Mechanics' Lien, in any matter permitted under the New Jersey law, and deduct all costs incurred in connection therewith from amounts otherwise owed to the Contractor under the Contract. The foregoing remedies shall be cumulative. In exercising its rights and remedies set forth in this Section, the Owner shall not be required to present a claim in accordance with the procedure or timeframe set forth in Article 6 or the A201.

15. Assignments/ Subcontracting: The Parties agree that there will be no Assignment and/or subcontracting of this Work without prior written consent and approval of the Owner.

16. The Contractor agrees to abide by any precautionary measures dictated by law, Executive Order, the Owner's direction, or any other applicable authority related to controlling the spread or resurgence of COVID-19, including but not limited to advising Owner of any employee or representative of Contractor that has tested positive for coronavirus, or is otherwise required to quarantine due to possible coronavirus exposure, and removing the employee from the job site until there is no longer any risk of exposure. Contractor shall require its subcontractors to comply with this paragraph.

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor as modified by the Owner and documents referenced in Article 1 of the same.

.2 The A201 as modified by the Owner.

.3 Drawings – **SEE THE ATTACHED INDEX**

.4 Specifications **SEE THE ATTACHED INDEX**

.5 Addenda, if any:

Number	Date	Pages

.6 Other Exhibits:

(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

[« »] AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:
(Insert the date of the E204-2017 incorporated into this Agreement.)

« »

[« »] The Sustainability Plan:

[X] Supplementary and other Conditions of the Contract: **AS INCORPORATED INTO THE A201.**

.7 Other documents, if any, listed below:

(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201™–2017 provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.)

Mandatory Equal Employment Opportunity Language, annexed hereto and made a part hereof

New Jersey Department of Labor and Workforce Development Prevailing Wage Rate Determination.

In the event of any conflict or inconsistency between any of the Contract Documents, the interpretation most favorable to the Owner and/or which imposes upon Contractor a greater obligation shall control.

This Agreement entered into as of the day and year first written above.

OWNER *(Signature)*	**CONTRACTOR** *(Signature)*
« »« »	« »« »
(Printed name and title)	*(Printed name and title)*

AIA® Document A201® – 2017

General Conditions of the Contract for Construction

TABLE OF ARTICLES

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.

INDEX
(Topics and numbers in bold are Section headings.)

ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement as modified by the Owner, and Modifications issued after execution of the Contract. A Modification is (I) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. In the event of any conflict or inconsistency between any of the Contract Documents, the interpretation most favorable to the Owner and/or which imposes upon Contractor a greater obligation, shall control.

§1.1.1.1 The Contract Documents shall include, but not be limited to advertisement or Invitation to Bid, Instructions to Bidders, the Contractor's Bid Proposal Form and other bidding forms, Addenda or portions of the Addenda relating to any Bidding Documents, Payment and performance Bonds, Certificates of Insurance, the General Terms and Conditions, Drawings and Specifications and any other documents enumerated in the Owner-Contractor Agreement. The Contract Documents shall apply to all Prime Contractors for the Project and each Prime Contractor is responsible for the content of all.

§ 1.1.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (I) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants, or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§1.1.2.1 The Contractor acknowledges and warrants that it has closely examined all of the Contract Documents; that they are suitable and sufficient to enable the Contractor to timely complete the Work for the Contract Sum; that they include all Work, whether or not shown or described, which reasonably may be inferred to be required or useful for the completion of the Work and for the Work to be in full compliance with all applicable codes, laws, ordinances and regulations; and that questions regarding the bid documents and any interpretation(s) regarding same have been asked by the Contractor, in the form and manner required in the instructions to bidders.

§ 1.1.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§1.1.3.1 It is strongly encouraged for the Contractor to visit the site of the Project before submitting a bid. Such site visit shall be for the purpose of familiarizing the Contractor with the conditions as they exist and the character of the operations to be carried on under the Contract Documents, including all existing site conditions, access to the site, physical characteristics of the site and surrounding areas. Whether or not Contractor visits the site, Contractor shall be charged with such knowledge and familiarity with the site as would have been obtainable from a thorough site visit and comprehensive inspection.

§1.1.3.2 Nothing in these General Conditions shall be interpreted as imposing on either the Owner or Architect, or their respective agents, employees, officers, directors or consultants, any duty, obligation or authority with respect to any items that are not intended to be incorporated into the completed project, including but not limited to shoring, scaffolding, hoists, temporary weatherproofing, or any temporary facility or temporary activity, since these are the sole responsibility of the Contractor.

§ 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

§ 1.1.5 The Drawings

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.5.1 The Drawings are diagrammatical and show the general arrangement and extent of the Work; exact locations and arrangements of parts shall be determined as the Work progresses, shall be subject to the Architect's approval, and shall not result in the extension of the Contract Time or additional compensation.

.1 The right is reserved by the Architect to make any reasonable change in location of equipment, ductwork, and piping prior to roughing in without involving additional expense to the Owner or extensions of Contract Time.

.2 Contractor shall coordinate his Work with the Work of others and shall be responsible for the coordination work, so that interference between mechanical, electrical, architectural, structural and other work does not occur.

.3 Contractor shall furnish and install supports, hangers, offsets, bends, turns, and the like in connection with this Work to avoid interference with work of other Contractors, to conceal Work where required, and to secure necessary clearance and access for operation and maintenance without involving additional expense to the Owner or extensions of Contract Time.

§ 1.1.6 The Specifications

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services which include the Instructions to Bidders, the Advertisement and forms required at the time of and after the receipt of the bids.

§ 1.1.7 Instruments of Service

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of reasonable interpretations or decisions rendered in good faith. The Architect shall be the Initial Decision Maker.

§1.1.9 Knowledge

Knowledge. The terms "knowledge," "recognize," and "discover," their respective derivatives, and similar terms in the Contract Documents, as used in reference to the Contractor, shall be interpreted to mean that which the Contractor knows (or should know), recognizes (or should recognize), and discovers (or should discover) in exercising the care, skill, and diligence required by the Contract Documents. Analogously, the expression "reasonably inferable" and similar terms in the Contract Documents shall be interpreted to mean reasonably inferable by a Contractor generally familiar with the Project, the type of construction work required, and the circumstances attendant to the Project site and by a Contractor exercising the care, skill, and diligence required of the Contractor by the Contract Documents.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The Contract Documents include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary or useful to produce the indicated results.

§ 1.2.1.1 The general character of the detail work is shown on the drawings, but minor modifications may be made in large scale details. Where the word "similar" occurs on the drawings it shall be used in its general sense and not as meaning identical, and all details shall be worked out by Contractor, consistent with the requirements of the Contract Documents, in relation to their location and their connection to other parts of the work.

.1 Where on any drawings a portion of the work is drawn out and the remainder is indicated in outline, the parts drawn out shall apply also to other like portions of the work.

.2 Where detail is indicated by starting only, such detail shall be continued throughout the courses or parts in which it occurs and shall also apply to all other similar parts in the work unless otherwise indicated.

.3 In case of differences between small and large-scale drawings, the larger scale drawings shall take precedence. Dimensions given shall take precedence over scale measurements.

.4 Any discrepancies or questions as to the application of, and interpretations related to 1.2.1.1, shall be referred to the Architect for adjustment before any work affected thereby has been performed.

§1.2.1.2 During the course of the work, should any ambiguities or discrepancies be found in the Specifications or on the Drawings; or should there be found any discrepancies between the Drawings and Specifications to which the Contractor has failed to call attention before submitting his bid, then the Architect will interpret the intent of the Drawings and Specifications; and the Contractor hereby agrees to abide by the Architect's interpretation and to carry out the work in accordance with the decision of the Architect.

§1.2.1.3 It is expressly stipulated that neither the Drawings nor the Specifications shall take precedence over the other, and it is further stipulated that the Architect may interpret or construe the Drawings and Specifications so as to secure in all cases the result most consistent with the needs and requirements of the work. In the event of such ambiguity or discrepancy subject to any Architect's interpretation, the Contractor shall comply with the more stringent requirement, and supply the better quality or greater quantity of work.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§1.2.2.1 The various materials and products specified in the specifications by name or description are given to establish a standard of quality and of cost for bid purposes. It is not the intent to limit the acceptance to any one material or product specified, but rather to name or describe it as the absolute minimum standard that is desired and acceptable, all determinations as to equality of a proposed product or material shall be at the discretion of the Architect and/or the Owner.

.1 A material or product of lesser quality will not be acceptable.

.2 Where "Basis of Design" products or manufacturer's names are used, whether or not followed by the words "or approved equal," they shall be subject to approved equals and authorized only by the Architect and/or the Owner.

.3 Insofar as practicable, except as otherwise specified or shown, the material or product of one manufacturer shall be used throughout the work for each specified purpose.

§1.2.2.2 Substitutions lowering performance, quality, method of assembly or installation, or in general not in keeping with details and specifications, will not be permitted. Refer to substitution procedure indicated elsewhere in the Contract Documents.

§1.2.2.3 It is understood when a bid for any product or material is submitted, the Contractor is aware of specified requirements and all materials or products within its bid are equal or better than such specified items. The Contractor is aware that any pricing decisions utilizing substitutes are at Contractor's own risk that the Architect and/or the Owner will find the substitutes not equal or better than the specified items; in such sole cases the Contractor shall use the specified items or seek approval of different products asserted to be equal to or better than the specified items. In no event shall Contractor's requests to use substitutes delay Contractor's performance or entitle Contractor to an extension of the Contract Time.

§1.2.2.4 In addition to the Specifications, it shall be understood that details on Drawings shall become part of the Specification in determining the required "standard of quality."

§1.2.2.5 If a conflict occurs between Drawing details and Specifications, bidder during bidding process and/or Contractor shall bring such conflicts to the attention of the Architect as soon as possible in accordance with applicable requirements indicated elsewhere in other sections of Contract Documents.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined in this document or the Agreement, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 Interpretation

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants. Drawings, specifications and other documents, including those in electronic form, prepared by the Architect and the Architect's consultants are Instruments of Service for use solely with respect to this Project, except that Owner shall be authorized to use any Instruments of Service for future maintenance or repair of or additions or alterations to this Project or for other Projects. The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service and shall retain all common law, statutory and other reserved rights, including copyrights.

§ 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement. All notices to Owner, Architect or Construction Manager shall be provided to each of the Owner, Architect and Construction Manager.

§ 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery. In addition, Notices of Claims shall also be provided by electronic transmission.

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form.

§ 1.8 INTENTIONALLY OMITTED

§ 1.9 EXECUTION OF CONTRACT DOCUMENTS

§ 1.9.1 The Contract Documents shall be signed by the Owner and Contractor. If either the Owner or Contractor or both do not sign all the Contract Documents, the Architect shall identify such unsigned Documents upon request. Execution of the Agreement and performance thereunder by Contractor shall constitute Contractor's acceptance of all unsigned Contract Documents as if they were fully executed, but this shall not impact Contractor's obligation to sign such documents. The Agreement shall be signed in not less than triplicate by the Owner and Contractor.

§ 1.9.2 Submission of a bid by the Contractor is a representation that said Contract Documents are full and complete, are sufficient to have enabled the Contractor to determine the cost of the Work therein and to enter into the Contract and that the Contract Documents are sufficient to enable it to construct the Work outlined therein, and otherwise to satisfactorily and completely fulfill all its obligations hereunder, including, but not limited to, Contractor's obligation to construct the Work for an amount not in excess of the Contract Sum on or before the date(s) of Substantial Completion and Final Completion established in the Agreement. The Contractor further acknowledges and declares that it has visited and examined the site, examined all physical, legal, and other conditions affecting the Work and is fully familiar with all of the conditions thereon and thereunder affecting the same. In connection therewith, Contractor specifically represents and warrants to Owner that it has, by careful examination, satisfied itself as to: (1) the nature, location and character of the Project and the site, including, without limitation, the surface and subsurface conditions of the site and all structures and obstructions thereon and thereunder, both natural and man-made, and all surface and subsurface water conditions of the site and the surrounding area; (2) the nature, location, and character of the general area in which the Project is located, including without limitation, its climatic conditions, available labor supply and labor costs, and available equipment supply and equipment costs; (3) the quality and quantity of all materials, supplies, tools, equipment, labor, and professional services necessary to complete the Work in the manner and within the cost and time frame required by the Contract Documents; and (4) the condition of existing and planned structures on the site and the ability, safety and appropriateness of same to receive the Work in the manner required by the Contract Documents. The potential that such physical, practical and intangible conditions are not as understood by Contractor at the time of its bid or that such physical, practical and intangible conditions may change during the course of performance, and the costs associated with such potential, are risks borne and accepted by Contractor. In connection with the foregoing and the remainder of the Contract Documents, and having carefully examined all Contract Documents, as aforesaid, and having visited the site, the contractor acknowledges and declares that it has no knowledge of any discrepancies, errors, omissions, ambiguities, or conflicts in said Contract Documents, has correlated its personal observations with the requirements of the Contract Documents, and that if it becomes aware of any discrepancies, errors, omissions, ambiguities, or conflicts, it will promptly notify Owner and Architect of such fact. The Contractor shall not be entitled to additional compensation or a reduction of the project scope or an extension of the Contract Time as a result of any of the foregoing.

§ 1.9.3 Any differences between the requirements of the Drawings and the Specifications or any differences noted within the Drawings themselves or within the Specifications themselves have been referred to the Owner and Architect by Contractor prior to the submission of bids and have been clarified by an Addendum issued to all bidders. The failure of a Contractor to provide notice of such a conflict prior to the question deadline in the Notice to Bidders shall constitute an absolute bar to the assertion of a claim based on the presence such conflict.

1.9.3.1 To "provide" work means to furnish and install, complete, in place and ready for use.

1.9.3.2 The Contractor shall request, from the Architect/Engineer's interpretation of apparent discrepancies, errors, conflicts, or omissions in the Specifications and Drawings. Subcontractors shall forward such requests through the Contractor. Such requests, and the Architect/Engineer's interpretation, shall be in written form; other forms of communications shall be used to expedite resolution of concerns, but will not be binding.

§1.9.3.3 Explanatory notes shall take precedence over conflicting drawn note indications.

§1.9.4 When more than one material, brand, or process is specified for a particular item of Work, the choice shall be the Contractor's. Contractor shall, after notifying the Architect and Owner, select the one it considers to be the best. Approval by Architect or Owner of materials, suppliers, processes, or Subcontractors does not imply a waiver of any

Contract requirements including, without limitation, Contractor's warranty.

§1.9.5 In all cases, the details, drawings, and specifications shall be checked with existing conditions and with work in place, and variations, if any, shall be referred by the Contractor to the Architect for adjustment, as the Contractor will be responsible for the fit or work in place.

§1.9.6 When a profile, section or other finished condition is shown, furring or other method of obtaining such finished conditions shall be provided.

§1.9.7 Where it is required in the specifications that materials, products, processes, equipment, or the like be installed or applied in accordance with manufacturers' instructions, directions, or specifications, or words to this effect, it shall be construed to mean that said application or installation shall be in strict accordance with printed material concerned for use under conditions similar to those at the job site. Three copies of such instructions shall be furnished to the Architect and his written approval thereof obtained before work is begun. If there is any variance between the manufacturers' instructions, directions or specifications and the Specifications, the Contractor shall seek clarification from the Architect.

§1.9.8 Any material specified by reference to the number, symbol, or title of a Commercial Standard, Federal Specification, ASTM Specification, trade association standard, or other similar standards, shall comply with the requirements in the latest revision thereof and any amendments or supplements thereto in effect one month prior to the date on which bids are opened and read, except as limited to type, class, or grade, or modified in such reference. The standards referred to, except as modified in the specifications, shall have full force and effect as though printed in the specifications. The Architect will furnish upon request information as to how copies of the standards referred to may be obtained.

§1.9.9 The Contractor represents and warrants the following to the Owner (in addition to the other representations and warranties contained in the Contract Documents), as an inducement to the Owner to execute the Owner-Contractor Agreement, which representations and warranties shall survive the execution and delivery of the Owner-Contractor Agreement and the final completion of the Work

.1 that it is authorized to do business in the State, County, and / or City where construction will take place at the Project and is properly licensed by all necessary governmental and public authorities having jurisdiction over it and over the Work and the site of the Project;

.2 that it is familiar with all Federal, State, Municipal and Owner laws, ordinances and regulations, which may in any way affect the work of those employed herein, including but not limited to any special acts relating to the work or to the project of which it is a part;

.3 that such temporary and permanent work required by the Contract Documents as is to be done by it, can be satisfactorily constructed and used for the purposes for which it is intended;

.4 that it is familiar with local trade jurisdictional practices at the site of the project;

.5 that it has carefully examined the plans; the specifications and the site of the work, and that from his own investigations, it has satisfied itself as to the nature and location of the work, the character, quality and quantity of the surface and subsurface materials to be encountered, the character of equipment and other facilities needed for the performance of the work, and the general local conditions, and all other materials which may in any way affect the work or his/her performance;

.6 that it has determined what local ordinances, if any, will affect his work. It has checked for any County, City, Borough, or Township rules or regulations applicable to the area in which the Project is being constructed and in addition, for any rules or regulations of other organizations having jurisdiction, such as chambers-of-commerce, planning commission, industries, or utility companies who have jurisdiction over property on which the Work will be performed. Any costs of compliance with local controls are included in the prices bid, even if documents of such local controlling agencies are not listed specifically in the Contract Documents.

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as

otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

§ 2.2 INTENTIONALLY OMITTED

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.3.2 The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect and shall succeed to all rights and responsibilities of Architect.

§ 2.3.4 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely only on the accuracy of the legal limitations furnished by the Owner and shall exercise proper precautions relating to the safe performance of the Work. The furnishing of these surveys and the legal description of the site shall not relieve the Contractor from its duties under the Contract Documents. Neither Owner nor the Architect shall be required to furnish Contractor with any information concerning subsurface characteristics, utilities or conditions of the areas where the Work is to be performed or concerning the structures on/in which the Work is to be performed. When the Owner or Architect has made investigations of subsurface characteristics or conditions of the areas where the Work is to be performed or concerning the structures on/in which the Work is to be performed, such investigations, if any, were made solely for the purposes of Owner's study and Architect's design. Neither such investigations nor the records thereof are a part of the Contract between Owner and Contractor. To the extent such investigations or the records thereof are made available to Contractor by the Owner or Architect, such information is furnished solely for the convenience of Contractor. Neither Owner nor Architect assumes any responsibility whatsoever in respect of the sufficiency or accuracy of the investigations thus made, the records thereof, or of the interpretations set forth therein or made by the Owner or Architect in its use thereof, and there is no warranty or guaranty, either express or implied, that the conditions indicated by such investigations or records thereof are accurate or that the indicated conditions are representative of those existing throughout the areas or structures where the Work is to be performed, or any part thereof, or that unforeseen developments may not occur, or that materials other than or in proportions different from those indicated may not be encountered. The Contractor shall undertake such further investigations and studies as may be necessary or useful to determine subsurface characteristics and conditions. In connection with the foregoing, Contractor shall be solely responsible for locating (and shall locate prior to performing any Work) all utility lines, telephone company lines and cables, sewer lines, water pipes, gas lines, electrical lines, including, without limitation, all buried pipelines and buried telephone cables and shall perform the Work in such a manner so as to avoid damaging any such lines, cables, pipes, and pipelines.

§ 2.3.5 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work, directly or through the Architect, with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.3.6 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2 and 1.5.3.

§ 2.4 Owner's Right to Stop the Work

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or fails to carry out Work in accordance with the Contract Documents, or fails or refuses to provide a sufficient amount of properly supervised and coordinated labor, materials, or equipment and in a satisfactory manner, so as to be able to complete the Work within the Contract Time or fails to remove and discharge (within ten days) any lien filed upon Owner's property or funds by anyone claiming by, through, or under Contractor, disregards the instructions of Architect or Owner when based on the requirements of the Contract Documents or otherwise violates any terms and conditions of the Contract Documents the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity.

§ 2.4.1 Notwithstanding anything else in the Contract Documents, the Owner shall have the authority to immediately correct, service, repair, replace or otherwise make operational any component of their facilities including equipment if in the sole discretion of the owner the damaged component is a threat to education, safety or security. The Owner is obligated to put the Contractor on notice of the issue threatening education, safety or security, and the Owner's intent to remedy immediately with other resources and to back charge the Contractor for the cost of said service, but there is no obligation to provide Contractor an opportunity to cure required for corrective actions necessary to protect the Owner's interest in education, safety and security.

§ 2.5 Owner's Right to Carry Out the Work

§ 2.5.1 If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and (i) fails within a seven-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness or (ii) Owner and Architect reasonably believe that such correction cannot be properly completed within a fourteen-day period, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect at Contractor's sole expense and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's and Construction Manager's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor and/or its Surety shall pay the difference to the Owner.

§ 2.5.2 The Owner's rights and remedies stated in Sections 2.4, 2.5 and elsewhere in the Contract Documents are cumulative and not in limitation of any other rights or remedies of the Owner (i) granted in the Contract Documents; (ii) at law; or (iii) in equity.

ARTICLE 3 CONTRACTOR

§ 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative. The Contractor is responsible for supervisory control over and allocation and coordination of all Subcontractors and trades, performance and completion of all portions of the Work, including cooperation with those doing portions of the Project under Separate Contracts with the Owner.

§ 3.1.2 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.1.3 Standard of Care: The Contractor shall exercise the highest and best skill, judgment, and care of a contractor performing work of the type required by the Contract Documents. Contractor acknowledges that this provision requires that it perform with more than a mere "reasonable" or workmanlike standard of care.

§ 3.2 Requests for Information; Field Conditions

§ 3.2.1 If the Contractor requires clarification of the intent of the Contract Documents after award, the Contractor shall be responsible to issue a typewritten request for information (RFI) to the Architect and Construction Manager utilizing the Architect or Construction Manager's sample form via acceptable methods set forth in Article 4.2.

All RFI's shall clearly identify the Architect's project number, the construction company's name, author's name, date issued, address, phone numbers, facsimile number and the addressee of the communication.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. The Contractor shall satisfy itself as to the accuracy of all dimensions and locations. In all cases of interconnection of its work with existing or other work, it shall verify at the site, all dimensions relating to such existing or other work. Any errors due to the Contractor's failure to verify all such locations or dimensions shall be promptly rectified by the Contractor without any additional cost to the Owner. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents. If the Contractor performs any construction activity involving an error, inconsistency, legal nonconformity, or omission in the Contract Documents that the Contractor was obliged to recognize pursuant to the terms of the Contract Documents, the Contractor shall assume complete responsibility for such performance and shall bear the full amount of the attributable costs for correction and any damages to Owner, Architect, Construction Manager, or Separate Contractors arising from that work.

§ 3.2.2.1 Contractor acknowledges, The Work required by the Contract Documents, including, without limitation, all construction details, construction means, methods, procedures, and techniques necessary to perform the Work, use of materials, selection of equipment, and requirements of products by manufacturers are consistent with;

.1 the highest and best skill, judgment, and care within the construction industry and applicable to the Work;
.2 requirements of any warranties applicable to the Work; and
.3 all laws, ordinances, regulations, rules, and orders which bear upon the Contractor's performance of the Work.

§ 3.2.2.2 The Contract Sum is firm and all inclusive, and no escalation is contemplated for any reason whatsoever. The Contract Sum includes any and all costs associated with substantial and final completion by the dates and times specified, including any and all costs associated with out-of-sequence work, come-back work, stand-by work, stacking of trades, coordination with the schedules and work of Separate Contractors, allowing sufficient time, work and storage areas, and site access for Separate Contractors to timely progress and complete their work, overtime, expediting and acceleration that may be required to complete the work by those dates and times.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly provide notice to the Architect of any legal nonconformity discovered by or made known to the Contractor.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information, the Contractor shall submit Claims as provided in Article 15.

§ 3.2.5 Typographical and spelling errors will be interpreted by the Architect for their intended meaning and the interpretations of the Architect shall be final and binding.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.3.4 The Contractor, when requested by the Architect or Construction Manager, shall meet with representative of the Architect or Construction Manager at all times and furnish all information requested; it shall allow the Architect and Construction Manager to inspect the work at all times. Neither the Owner, nor the Architect or Construction Manager shall be liable to the Contractor for extra compensation or damages for interference or delays on account of any such meetings, information, or inspections so requested or other acts of the Architect or Construction Manager done in good faith and within the scope of their employment by the Owner.

§ 3.3.5 The Contractor has the responsibility to ensure that all material suppliers and Subcontractors, their agents, and employees adhere to the Contract Documents, and that they order materials on time, taking into account the current and potential market and delivery conditions and that they provide materials on time. The Contractor is aware of the presence of market volatility and potentiality for significant delivery delays and has assumed the risk of same. The Contractor shall coordinate its Work with that of all others on the Project including deliveries, storage, installations, and construction utilities. The Contractor shall be responsible for the space requirements, locations, and routing of its equipment. In areas and locations where the proper and most effective space requirements, locations and routing cannot be made as indicated, the Contractor shall meet with all others involved, before installation, to plan the most effective and efficient method of overall installation.

§ 3.3.6 The Contractor shall establish and maintain benchmarks and all other grades, lines, and levels necessary for the Work and review the placement of the building(s) and permanent facilities on the site with the Owner and Architect after all lines are staked out and before foundation Work is started. Contractor shall provide access to the Work for the Owner, the Architect, other persons designated by Owner, and governmental inspectors. Any encroachments made by Contractor or its Subcontractor (of any tier) on adjacent properties due to construction as revealed by an improvement survey, except for encroachments arising from errors or omissions not reasonably discoverable by Contractor in the Contract Documents, shall be the sole responsibility of the Contractor, and Contractor shall correct such encroachments within thirty (30) days of the improvement survey (or as soon thereafter as reasonably possible), at Contractor's sole cost and expense, either by the removal of the encroachment (and subsequent reconstruction on the Project site) or agreement with the adjacent property owner(s) (in form and substance satisfactory to Owner in its sole discretion) allowing the encroachments to remain.

§3.3.6.1 Contractor shall only employ or use labor in connection with the Work capable of working harmoniously with all trades, crafts, and any other individuals associated with the Project. The Contractor shall also use best efforts to minimize the likelihood of any strike, work stoppage, or other labor disturbance.

.1 If the Work is to be performed by trade unions, the Contractor shall make all necessary arrangements to reconcile, without delay, damage, or cost to the Owner and without recourse to the Engineer or the Owner, any conflict between the Contract Documents and any agreements or regulations of any kind at any time in force among members or councils that regulate or distinguish the activities that shall not be included in the work of any particular trade.

.2 In case the progress of the Work is affected by any undue delay in furnishing or installing any items or materials or equipment required under the Contract Documents because of such conflict involving any such labor agreement or regulation, the Owner may require that other material or equipment of equal kind and quality be provided pursuant to a Change Order or Construction Change Directive.

§ 3.3.7 Coordination:

1. The Contractor is the sole responsible party for the coordination of the entire project.
2. The Contractor shall be responsible to coordinate and expedite the total construction process and all of its parts. The Owner relies upon the organization, management, skill, cooperation and efficiency of the Contractor to supervise, direct, control and manage the work and to coordinate and expedite the efforts of Separate Contractors and subcontractors so as to deliver the Work conforming to the contract within the scheduled time. The Contractor is responsible for proper sequence and coordination. It shall determine the location of work and attempt to resolve conflicts amongst itself and Separate Contractors and subcontractors.
3. The Owner has hired a CONSTRUCTION MANAGER to provide on-site Project Management services. The Construction Manager and the Architect will share administrative duties, which will be delineated at the Pre-construction conference. The Construction Manager will essentially be the liaison between Owner, Architect, Contractor and Separate Contractors deferring to the Contractor and Separate Contractors for means and methods, deferring to the Architect for final clarifications and determinations of disputes, design issues, and aesthetics and ensuring Owner's voice and interests are represented as the Project proceeds. The Construction Manager, along with the Architect, will manage the following processes – shop drawings, change orders, payments, correspondence, RFI's, construction schedules, documentation, job meetings, quality assurance, punchlists, etc.
4. The Contractor shall provide a qualified full-time staff member or members to manage the project. THIS PROJECT MANAGER shall coordinate, organize and manage the project from the Contractor's main office and oversee the shop drawing process signing off for quality assurance and conformance with the Contract Documents on each shop drawing. The Project Manager shall be subject to the approval of the Owner, Construction Manager and Architect who at all times have the right to require the Contractor to replace this Project Manager if their performance is not reasonably satisfactory. The Project Manager shall conduct an onsite meeting at least once a week with the construction superintendent and all Separate Contractors and/or subcontractors in attendance to coordinate the project and review the schedule. The Construction Manager will attend but is not responsible for organizing or taking minutes. The Project Manager shall provide a meeting agenda and issue minutes within four (4) working days of each meeting.
5. The Contractor shall provide a qualified full-time staff member or members to manage the project on site. THIS CONSTRUCTION SUPERINTENDENT and their assistants shall coordinate, organize and manage the project from the Contractor's on-site field office and oversee Contractor's own work and the work of its subcontractors. Should the Contractor be responsible for multiple projects at different sites, multiple locations on one large site or a multiple-site project under one contract then the Contractor shall provide a separate qualified Construction Superintendent for each of the projects or locations. This determination shall be made by Owner, Construction Manager and Architect who at all times may require additional manpower. The Construction Superintendent shall be responsible for onsite safety, quality assurance, conformance with the Contract Documents and perform coordination with all on site construction personnel and/or subcontractors. The Construction Superintendent and their assistants shall be subject to the approval of the Owner, Construction Manager and Architect, who at all times have the right to require the Contractor to replace this Construction Superintendent and any assistant if their performance is not reasonably satisfactory
6. Contractor's Subcontractors shall also have a designated superintendent and/or foreman who will at all times be subject to the approval of the Owner, Construction Manager and Architect. The Owner, Construction Manager and Architect reserves the right to require the Contractor to replace the superintendent and/or foreman if their performance is not reasonably satisfactory; Contractor's Subcontractors shall be required to consent to same under the terms of their subcontracts.
7. Each Subcontractor shall coordinate its activities with the activities of Contractor, Separate Contractors and other subcontractors.
8. All questions pertaining to the Work are to be made, via request for information, to the Architect sufficiently in advance of performance to permit Architect time to thoroughly evaluate and investigate the

request and provide a written response without delaying the progress of the Work. Contractor shall be responsible for any delay occasioned by the failure to timely submit a request for information based on the standard in this paragraph.

9. The Contractor is required to submit a site logistics plan coordinating all Owner and Construction Manager functions with the access and safety of the job site.
10. The Contractor is required to coordinate all the inspection and material testing to meet the Contract Documents requirements.
11. The Contractor has full and sole responsibility for construction methods and implementation of a "quality control system" to insure coordination.
12. The Contractor shall make all necessary arrangements to conduct work so that all parts shall be carried on harmoniously and simultaneously or sequentially, so as components or increments of the same shall not interfere or retard the progress of others.
13. The Contractor shall coordinate the delivery, unloading, movement, relocation, storage and protection of all materials.
14. Accurate dimensions, sleeved and opening drawings are to be submitted by Contractor to Architect prior to placement in the field.
15. The Contractor shall prepare coordination drawings for all above ceiling areas throughout the entire project. Such drawings shall show all piping, duct, cable trays, electrical duct banks, similar items (but not electrical conduit less than 4 inches in diameter), and complete architectural, mechanical and electrical reflected ceiling layouts, (including ductwork, conduits, piping, lighting, etc.).
16. The Contractor is responsible for any omissions of the Subcontractors and is required to provide a complete operating facility.
17. The Contractor shall be responsible for preserving the integrity of ceiling heights and room sizes and shall:
    a. Check compatibility with equipment, other work, electrical characteristics, and operational control requirements; check motor voltages and control characteristics; coordinate controls, interlocks, wiring of pneumatic switches, and relays; coordinate wiring and control wiring diagrams; review the effect of changes on other work; and obtain and distribute installation data on each item of equipment requiring mechanical or electrical connections;
    b. Coordinate and observe start-up and demonstration of equipment and systems; observe and maintain records of tests and inspections; and coordinate maintenance of record documents;
    c. Assist the Construction Manager and any of Construction Manager, Architect, or Owner's consultants with final inspections.
    d. Inform the Owner via the Construction Manager when coordination of Owner's work is required;
    e. Coordinate all mechanical, plumbing, electrical, food service and equipment/furnishings work, and coordinate that work with all other work.
18. Where space is liinited, Contractor shall show plan and cross-section dimensions of space available, including structural obstructions and ceilings as applicable.
19. Contractor shall coordinate cutting and patching activities and sequencing with Separate Contractors and subcontractors.

§ 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive and the provisions of Section 01300 of the Contract Specifications.

§ 3.4.2.1 The Architect will evaluate alternatives and substitutions and shall be the sole judge of whether the alternatives and substitutions are acceptable.

.1 The burden of proving the alternatives and substitutions are equal to or better than the specified product is that of the Contractor.
.2 Contractor shall submit request for substitution in accordance with substitution procedures indicated elsewhere in the Contract Documents.
.3 Products which do not meet the specifications will not be accepted.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.4.4 The Contractor must provide suitable storage facilities at the site for the proper protection and safe storage of his materials. Such storage facilities must be approved in advance in writing by the Architect.

§ 3.4.5 All materials delivered to the premises which are to form a part of the work are to be considered the property of the Owner and must not be removed without the Architect's consent; but the Contractor shall remove all surplus materials upon completion of each phase of the work and as directed by the Architect.

§ 3.4.6 When any room is used as a shop, storeroom, etc., during the progress of the work, the Contractor making use of the space will be responsible for any repairs, patching, or cleaning arising from such use. Prior approval of the Construction Manager or Architect for use of such areas is mandatory.

§ 3.4.7 Not later than seven (7) days from the execution of the Agreement, the Contractor shall provide a list showing the name of the manufacturer proposed to be used for each of the products identified in the Specifications Divisions 1-16, and if applicable, the installing Subcontractor's name.

§ 3.4.8 The Contractor will be held to be thoroughly familiar with all conditions affecting labor in the locale of the Project, including, but not limited to, trade jurisdictions and agreements, incentive and premium time, pay, procurement, living and commuting conditions. Contractor shall assume responsibility for costs resulting from his failure to verify conditions affecting his labor.

§ 3.4.9 Except as specifically provided in Subparagraph 8.3.1, Contractor shall be liable to Owner for all damages suffered by Owner occurring as a result of work stoppages, slowdowns, disputes, or strikes.

§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work shall conform to the requirements of the Contract Documents and shall be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment. This Section shall not shorten or limit the manufacturer's warranties in any way.

§ 3.5.2 The Contractor represents that all manufacturer and supplier warranties shall run directly to or be specifically assignable to the Owner. The Contractor warrants that all portions of the work that will be covered by a manufacturer or supplier's warranty shall be performed in such a manner so as to preserve all rights under such warranties. All such warranties shall commence in accordance with Section 9.8.4, Substantial Completion. The Contractor hereby assigns to the Owner, effective upon the earlier of termination of this contract or substantial completion, all manufacturer and supplier's warranties relating to the Work, and the Contractor shall upon request of the Owner, execute any document reasonably requested by Owner to effectuate such assignment. If the Owner attempts to enforce a claim based upon a manufacturer or supplier's warranty and such manufacturer or supplier refuses to honor such warranty based in whole or in part on a claim of defective installation by the Contractor, the Contractor shall be responsible for any resulting loss or damages incurred by the Owner as a result of the manufacturer or supplier's refusal to honor such warranty. The Contractor's obligations under this Section 3.5.2 shall survive the expiration or earlier termination of the Contract. The warranty period for all work of each Contractor shall be two (2) years from the date of final inspection and acceptance by the Owner unless otherwise specified.

§ 3.6 Taxes

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.6.1 The owner is exempt from all taxes including Federal Excise Tax, fuel tax, transportation taxes and State Sales or Use Tax.

§ 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 The Contractor shall be required to secure permits or government approvals necessary for the proper execution and completion of the work. The Contractor shall obtain business licenses required by the State, County and/or City/Township and shall give all notices and comply with all laws, ordinances, rules, regulations and orders of any public authority bearing on the performance of the work.

§ 3.7.1.1 The required Building Permit or Permits and/or other local governmental approvals shall be secured by the Contractor for the entire project. This shall include permits required for the Construction Manager's Trailer.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 In addition to any other obligation under similar provisions of the Contract Documents, if the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear all costs attributable to the correction thereof or related thereto, including all fines and penalties.

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than three (3) days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially shall direct any necessary re-design of the Work. As set forth in Article 1, Contractor accepts the risk of concealed or unknown conditions.

§3.7.4.1 If it shall be determined by a court of competent jurisdiction that Contractor cannot bear the full risk of concealed or unknown conditions as a matter of law, adjustment in the Contract Time or Contract Sum shall be permitted only for conditions that differ materially from those conditions specifically disclosed by Owner, Architect, or Construction Manager or unusual and adverse conditions actually known to Owner, Architect, or Construction Manager that should have reasonably been disclosed to Contractor.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features.

§ 3.8 Allowances (See Specification "Section 01210 – Allowances")

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

.1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and all required taxes, less applicable trade discounts;

.2 whenever costs of materials and equipment are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect the difference between actual costs of material and equipment and the allowances under Section 3.8.2.1, but shall not reflect changes in the costs for unloading and handling at the site, labor, or installation costs.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 Superintendent

§ 3.9.1 The Construction Superintendent shall represent the Contractor, and communications given to the Construction Superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed Construction Superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed Construction Superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed Construction Superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the Construction Superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule prepared by the Contractor shall indicate the proposed starting and completion date for the various subdivisions of the Work as well as the totality of the Work. The schedule shall be updated every thirty (30) days and must be submitted to the Architect with Contractor's Applications for Payment. If the schedule is not submitted with the payment application, no payment will be processed. Each schedule shall contain a comparison of actual progress with the estimated progress for such point in time started in the original schedule. If any schedule submitted sets forth a date for Substantial Completion for the Work or any phase of the Work beyond the Date(s) of Substantial Completion established in the Contract (as the same may be extended as provided in the Contract Documents), then Contractor shall submit to Architect and Owner for their review and approval an explanation for the cause of the schedule slippage and a description of the means and methods which Contractor intends to employ to expedite the progress of the Work to ensure timely completion of the various phases of the Work as well as the totality of the Work. To ensure such timely completion, Contractor shall take all necessary action including, without limitation, increasing the number of personnel and labor on the Project and implementing overtime and double shifts. In that event, Contractor shall not be entitled to an adjustment in the Contract Sum or the schedule. Upon request and demand by Architect/Owner, Contractor shall provide a recovery schedule in accordance with the Specifications.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.10.4 Schedules shall comply with the requirements of the Division 1 "Section 01040 - Project Coordination," and Section 01310 - "Construction Progress Documentation. The Schedule shall also (i) provide a graphic representation

of all activities and events that will occur during performance of the Work; (ii) identify each phase of construction and occupancy; and (iii) set forth dates that are critical in ensuring the timely and orderly completion of the Work in accordance with the requirements of the Contract Documents (hereinafter referred to as "Milestone Dates").

§ 3.10.5 In the event the Owner determines that the performance of the Work, as of a Milestone Date, has not progressed or reached the level of completion required by the Contract Documents, the Owner shall have the right to order the Contractor to take corrective measures necessary to expedite the progress of construction, including, without limitation, (i) working Additional shifts or overtime, (ii) supplying Additional manpower, equipment, and facilities, and (iii) other similar measures (hereinafter referred to collectively as "Extraordinary Measures"). Such Extraordinary Measures shall continue until the progress of the Work complies with the stage of completion required by the Contract Documents. The Owner's right to require Extraordinary Measures is solely for the purpose of ensuring the Contractor's compliance with the construction schedule.

.1 The Contractor shall not be entitled to an adjustment in the Contract Sum or an extension of time in connection with Extraordinary Measures required by the Owner under or pursuant to this Subsection 3.10.5.
.2 The Owner may exercise the rights furnished the Owner under or pursuant to this Subsection 3.10.5 as frequently as the Owner deems necessary to ensure that the Contractor's performance of the Work will comply with any Milestone Date or completion date set forth in the Contract Documents.
.3 The Owner's failure to direct Extraordinary Measures shall in no event excuse Contractor's failure to maintain the schedule or timely reach substantial or final completion of the Work.

§ 3.10.6 The Owner shall have the right to direct a postponement or rescheduling of any date or time for the performance of any part of the Work that may interfere with the operation of the Owner's premises or any tenants or invitees thereof. The Contractor shall, upon the Owner's request, reschedule any portion of the Work affecting operation of the premises during hours when the premises are not in operation. Any postponement, rescheduling, or performance of the Work under this Subsection 3.10.6 may be grounds for an extension of the Contract Time, if permitted under Subsection 8.3.1, and an equitable adjustment in the Contract Sum if (i) the performance of the Work was properly scheduled by the Contractor in compliance with the requirements of the Contract Documents, (ii) Contractor was on schedule to timely reach substantial and final completion of the Work; and (iii) such rescheduling or postponement is required for the convenience of the Owner.

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and delivered to the Owner upon completion of the Work as a record of the Work as constructed. See Specification "Section 01300 - Submittals," and "Section 01700 - Project Closeout," for specific details and requirements.

§ 3.12 Shop Drawings, Product Data and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors. Submittals which are not marked as reviewed for compliance with the Contract Documents and approved by the Contractor may be returned by the Architect without action

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

§ 3.12.11 Detailed requirements are specified in Specification "Section 01300 - Submittals."

§3.12.12 All shop drawings are to include manufacturer's data. All shop drawings and samples are to be submitted by the Contractor to the Architect for review. Each sheet of the shop drawings shall identify the project, contractor, subcontractor, fabricator or manufacturer and the date of the drawings. All shop drawings shall be numbered in consecutive sequence and each sheet shall indicate the total number of sheets in the set.

§ 3.12.13 Substitutions: All substitutions or deviations from plans and specification must be clearly noted as such on all shop drawings. Contractor shall identify, coordinate and pay for any additional requirements as a result of substitutions, deviations, etc., including necessary change orders. In addition, substitution submittals shall be made no later than 30 days after the execution of the Agreement in order to provide time for comparison review. All submittals after 30 days shall be in strict accordance with the basis of design / specified products.

§ 3.13 Use of Site

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.13.1 Location and weights of all equipment and materials and the Contractor intends to place on the slab shall be submitted to the Architect for review.

§ 3.13.2 Only materials and equipment which are to be used directly in the Work shall be brought to and stored on the Project site by the Contractor. After equipment is no longer required for the Work, it shall be promptly removed from the Project site. Protection of construction materials and equipment stored at the Project site from weather, theft, damage and all other adversity is solely the responsibility of the Contractor.

§ 3.13.3 The Contractor and any entity for whom the Contractor is responsible shall not erect any sign on the Project site without the prior written consent of the Owner with the exception of those directed to be erected through the Contract Documents and those necessary for site safety or in an emergency.

§ 3.13.4 Contractor shall ensure that the Work, at all times, is performed in a manner that affords reasonable access, both vehicular and pedestrian, to the site of the Work and all adjacent areas. The Work shall be performed, to the fullest extent reasonably possible, in such a manner that public areas adjacent to the site of the Work shall be free from all debris, building materials and equipment likely to cause hazardous conditions. Without limitation of any provision of the Contract Documents, Contractor shall use its best efforts to minimize any interference with the occupancy or beneficial use of (1) any areas and buildings adjacent to the site of the Work or (2) the Building in the event of partial occupancy, as more specifically described in Paragraph 9.9.

§ 3.13.5 Without prior approval of the Owner, the Contractor shall not permit any workers to use any existing facilities at the Project site, including without limitation, lavatories, toilets, entrances and parking areas other than those designated by the Owner. Without limitation of any other provision of the Contract Documents, the Contractor shall use its best efforts to comply with all rules and regulations promulgated by the Owner in connection with the use and occupancy of the Project site and the Building, as amended from time to time.
The Contractor shall immediately notify the Owner in writing if during the performance of the Work, the Contractor finds compliance with any portion of such rules and regulations to be impracticable, setting forth the problems of such and suggest alternatives through which the same results can be achieved. The Owner may, in the Owner's sole discretion, adopt such suggestions, develop new alternatives or require compliance with the existing requirement of the rules and regulations. The Contractor shall also comply with all insurance requirements and collective bargaining agreements applicable to use and occupancy of the Project site and the Building.

§3.13.6 The Contractor shall provide a temporary construction fence whether shown on the contract documents or not as required to separate the area or areas under construction from the Owners area or areas used by the public. The temporary fencing shall be approved by the Owner prior to installation. The fence shall be 6' high and have vinyl privacy fabric obstructing views into the construction area.

§ 3.14 Cutting and Patching (See Specification "Section 01045 – Cutting and Patching")

§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

§ 3.15.3 The Contractor shall perform all daily clean up and removal of debris from the site including that of its Subcontractors. The Contractor shall maintain an adequate supply of laborers to accomplish daily clean up and removal of debris from the site and work areas. No debris will be allowed to accumulate in or around the building including masonry debris. The building site must be maintained free of all litter, dirt, dust and debris on a daily basis. The Owner, Architect or Construction Manager may stop all work and require all personnel on site to clean up. No accumulation of flammable material is permitted. Prior to installation of finishes, the floors will be swept or vacuumed and kept free of dust and dirt until turned over to the Owner. Contractor shall immediately notify Architect, Owner and Construction Manager in the event of snow and or ice accumulation in the site which can reasonably affect safety.

§ 3.15.4 Cleaning and debris removal may be considered a safety concern by judgment of the Owner, Construction Manager or Architect and as such the work may be stopped to provide time and labor for immediate clean up.

§ 3.15.5 Final Clean-Up: The Contractor has the responsibility for the final clean-up and policing of the entire site after Separate Contractors have removed their own waste materials, rubbish, equipment, tools and plant. In addition, thereto, the Contractor shall have a professional cleaning company perform the following immediately prior to the Architect's inspection for Substantial Completion:

.1 Removal of all manufacturer's temporary labels from materials, equipment and fixtures.
.2 Removal of all stains from glass and mirrors; wash, polish, inside and outside.
.3 Removal of marks, stains, fingerprints, other soil, dust, dirt, from painted, decorated, or stained woodwork, plaster or plasterboard, metal, acoustic tile, and equipment surfaces.
.4 Remove spots, paint, soil, from resilient flooring.
.5 Remove temporary floor protections; clean, strip and provide three (3) coats of wax on new VCT floors or otherwise treat as directed by the material manufacturer's recommendation, all finished floors. Final vacuum all carpet.
.6 Clean all interior finished surfaces, including doors and window frames, and hardware required to have a polished finish, of oil, stains, dust, dirt, paint, and the like; leave without fingerprints, blemishes.
.7 Final site clean-up shall extend beyond the Contract Limit Lines as reasonably required to ensure the complete removal of all construction debris from the entire site, including staging areas.

§ 3.16 Access to Work

The Contractor shall provide the Owner, Construction Manager and Architect with access to the Work in preparation and progress wherever located.

§ 3.16.1 The Contractor shall promptly notify the Architect, Construction Manager and Owner of the presence of hazardous conditions at the site, including the start of hazardous operations or the discovery or exposure of hazardous substances.

§ 3.16.2 Contractor shall be responsible for snow plowing and snow removal as required to maintain ingress to, egress from and mobility around construction areas.

§ 3.16.3 Contractor shall keep only necessary equipment on site and shall cooperate with the Owner regarding location of stored material.

§ 3.16.4 The Contractor is to maintain reasonable access to site for structural steel erection including crane, steel deliveries, etc. The Contractor will be responsible to coordinate requirements with the Construction Manager a minimum of 21 days prior to deliveries.

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall defend, indemnify and hold harmless the Owner, Architect, Construction Manager, and other consultants or professionals retained by Owner and their respective officers, employees, owners, volunteers and agents ("Indemnitees"), from and against all claims, damages, losses, and expenses, including reasonable attorney's fees and costs, in case it shall be necessary to file an action or claim or in case an action or claim is brought or made which is; 1) for personal or bodily injury, illness or death, for property damage, including loss of use, or for any economic loss and; 2) caused in whole or in part by Contractor's alleged negligent acts or omissions, breaches of contract, performance or failure to perform under the Agreement, or otherwise arising out of their work, or those of a Subcontractor, or that of anyone employed by them, or for whose acts Contractor or Subcontractor may be liable. Contractor's obligation hereunder shall apply in all instances whether the Indemnitees are made a party to the action or claim or are subsequently made a party to the action by third-party in-pleading or are made a part to a collateral action arising, in whole or in part, from any of the issues emanating from the original cause of action or claim. Contractor's obligation hereunder shall apply even when such claims, damages, losses and expenses are caused in part by the Indemnitees. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.1.1 Contractor shall defend, indemnify and hold harmless the Indemnitees against all fines, penalties or losses, including reasonable attorney's fees and costs, incurred as a result of violations by Contractor of any statute, ordinance, regulation, rule of law of any political subdivision or duly constituted public authority.

§ 3.18.1.2 The Contractor assumes the entire risk, responsibility, and liability for any and all damage or injury of every kind and nature whatsoever (including death resulting therefrom) to all persons, whether employees of the Contractor or otherwise, and to all property (including the Work itself) caused by, resulting from, arising out of or occurring in connection with the execution of the Work, or in preparation for the Work, or any extension, modification, or amendment to the Work by the Change Order or otherwise.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

§3.18.3 The Contractor assumes all risks and bears any costs and expenses occasioned by neglect or accident during the

progress of the Work until, at earliest, same shall have been completed and accepted by the Owner. The Contractor must properly protect all adjacent work during the progress of construction and make good all damage that may occur to any work herein specified or to adjacent property in consequence of the work herein specified.

§3.18.4 The work in every respect shall be under the care of the Contractor and at his risk, he shall properly safeguard against any or all injury or damage to the public, to any property, materials, or thing, except where stipulated otherwise in the specifications, and also be responsible for any such damage or injury from his undertaking of this work to any person or persons or thing connected therewith.

ARTICLE 4 ARCHITECT

§ 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement. The term "Architect" means the Architect or the Architect's authorized representative.

§ 4.1.2 Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner, Contractor, and Architect. Consent shall not be unreasonably withheld.

§ 4.1.3 If the employment of the Architect is terminated, the Owner shall employ a successor architect whose status under the Contract Documents shall be that of the Architect.

§ 4.2 Administration of the Contract

§ 4.2.1 The Architect and Construction Manager will provide administration of the Contract as described in the Contract Documents (1) during construction, (2) until final payment is due and (3) with the Owner's concurrence, from time to time during the two-year period for correction of Work described in Paragraph 12.2. The Architect and Construction Manager will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents, unless otherwise modified in writing in accordance with other provisions of the Contract.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications

The Owner and Contractor shall include the Architect and Construction Manager in all communications that relate to or affect the Architect or Construction Manager's services or professional responsibilities. The Owner shall promptly notify the Architect and Construction Manager of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner, Construction Manager and Architect. The Contract Documents may specify other communication protocols.

§ 4.2.5 Based on the Architect and Construction Manager's evaluations of the Contractor's Applications for Payment, the Architect and Construction Manager will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect and Construction Manager have authority to reject Work that does not conform to the Contract Documents. Whenever the Architect and Construction Manager considers it necessary or advisable, the Architect and Construction Manager will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect or Construction Manager nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect or Construction Manager to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect or Construction Manager will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect or Construction Manager will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect and Construction Manager will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 INTENTIONALLY OMITTED

§ 4.2.11 The Architect will interpret and decide matters concerning the Contractor's performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site or provide material or equipment directly to the Contractor. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Identification of Subcontractors required by N.J.S.A. 18A:18A-18 shall be provided with the bid in accordance with that statute. The names of all Subcontractors and material suppliers not covered by N.J.S.A. 18A:18A-18 shall be submitted to the Architect for approval not later than seven (7) days after the date of the notice to proceed. The list of proposed Subcontractors shall include a description of the materials and equipment each proposes to furnish and install in the work. The description shall be in sufficient detail to allow the Architect to determine general conformance to the Contract Documents. Approval of the submittals required under the Article shall not relieve the Contractor from conformance to the Contract Documents.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.2.1 The Architect will promptly reply in writing to the Contractor stating whether the Owner or Architect, after due investigation, has reasonable objection to any such proposed persons. If adequate data on any proposed Subcontractor or manufacturer is not available, the Architect may state that action will be deferred until the Contractor provides further data. Failure of the Owner or Architect to reply promptly shall not constitute a waiver of any of the requirements of the Contract Documents, and all materials and work furnished by the listed Subcontractor or manufacturer must conform to such requirements.

§ 5.2.3 INTENTIONALLY OMITTED

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected, or decide to self-perform such Work, if the Owner or Architect makes reasonable objection to such substitution or self-performance, including on the grounds that Contractor is attempting to improve its profits on the project without commensurate benefit to the Owner.

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the

proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.3.1 The Contractor shall obligate each Subcontractor specifically to comply with the New Jersey Law Against Discrimination NJ.S.A. 10:5-31 and N.J.A.C. 17:27 et seq. to avoid discriminatory practice in employment.

§ 5.3.2 The Contractor shall obligate each Subcontractor to comply with the applicable prevailing wage schedule of the New Jersey Department of Labor and Workforce Development.

§ 5.3.3 The Contractor shall obligate each Subcontractor to comply with the Public Works Contractor Registration Act, N.J.S.A. 34:11-56.48 et seq.

§ 5.4 INTENTIONALLY OMITTED

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 THE CONTRACTOR SHALL BE RESPONSIBLE TO COORDINATE ALL WORK. All trades have a mutual obligation to coordinate their work with the other trades and cooperate as necessary with the Contractor, Construction Manager and the Construction schedule – to complete the work as required by the Owner. The Construction Manager will provide assistance to the Contractor for coordination between their work and the Owner.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2. If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect and Construction Manager of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent. Should the Contractor be damaged by any Separate Contractor on the Project by reason of such Separate Contractor's failure to perform properly his Contract with the Owner, no action will lie against the Owner and the Owner shall have no liability therefore, but the Contractor may assert his claim for damage against such Separate Contractor as a third-party beneficiary under the Contract between such other Contractor and the Owner.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect and Construction Manager of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent. Should the Contractor be damaged by any Separate Contractor on the Project by reason of such Separate Contractor's failure to perform properly his Contract with the Owner, no action will lie against the Owner and the Owner shall have no liability therefore, but the Contractor may assert his claim for damage against such Separate Contractor as a third-party beneficiary under the Contract between such other Contractor and the Owner.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5 or to other completed or partially completed construction or to the site or adjoining property.
§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and will allocate the cost among those responsible as the Owner determines to be just, based on the recommendation of the Architect.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.1.1 A directive, order, field directive or field order shall not be recognized as constituting a change in the Work or the Contract Documents or having any impact upon the Contract Sum or the Contract Time, and the Contractor shall have no claim therefor unless it shall, prior to complying with same and in no event no later than five (5) working days from the date such direction or order was given, submit to the Owner, Architect and Construction Manager its change proposal for approval.

§ 7.1.1.2 When submitting its change proposal, the Contractor shall include and set forth in clear and precise detail breakdowns of labor and materials for all trades involved and the estimated impact on the construction schedule including a specific number of days for a time extension. If the proposal does not provide an additional time request, the Contractor shall not be entitled to an extension of time. The Contractor shall furnish spreadsheets from which the breakdowns were prepared, plus spreadsheets if requested of any Subcontractors. The Contractor may not claim additional time at a later date and shall remove any language to that effect from its proposal.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone in accordance with Paragraph 7.4.

§ 7.1.2.1 Except as permitted in Section 7.3 and Section 9.7, a change in the Contract Sum or the Contract Time shall be accomplished only by Change Order. Neither this Contract nor the Work to be performed hereunder can be changed by oral agreement. No course of conduct or dealings between the parties, nor express or implied acceptance of alterations

or additions to the Work and no claims that the Owner has been unjustly enriched by any alteration or addition to the Work, whether there is, in fact, any unjust enrichment, shall be the basis for any alleged implied agreement by the Owner to the change, any alleged waiver of the Owner's right under this Contract or any increase in any amounts due under the Contract or any or a change in any time period provided for in the Contract Documents.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Architect or Construction Manager and signed by the Owner, Contractor, Construction Manager and Architect stating their agreement upon all of the following:

.1 The change in the Work;

.2 The amount of the adjustment, if any, in the Contract Sum; and

.3 The extent of the adjustment, if any, in the Contract Time.

§ 7.2.2 Methods used in determining adjustments to the Contract Sum include those listed in Subparagraph 7.3.4 The total for overhead and profit shall NOT exceed 15% combined and shall not include markups below the Subcontractor level.

§ 7.2.3 Any change in work authorized in writing by the Owner and Architect that will require a change in the cost of the work, whether an additive or deductive change in cost, shall show a complete cost breakdown of labor, material, appropriate increase or reduction in overhead and profit (15% maximum combined) and contract time.

§ 7.2.4 When a Change Order involves both additions and deletions in material, the net quantity is to be determined and the 15% overhead and profit is to be applied to the net change.

§ 7.2.5 When any change in the Work, regardless of the reason therefore, requires or is alleged to require an adjustment in Contract Time, such request for time adjustment shall be submitted by the Contractor as part of the change proposal. Any Change Order approved by the Owner and for which payment is accepted by the Contractor, in which no adjustment in Contract Time is stipulated, shall be understood to mean that no such adjustment is required by reason of the change, and any and all rights of the Contractor or any subsequent request for adjustment of Contract Time by reason of the change is waived.

§ 7.2.6 Request by the Contractor for adjustment of the Contract Amount regardless of the reason therefore, shall be submitted to the Architect and the Owner with itemized labor and material quantities and unit prices to permit proper evaluation of the request. A submission by the Contractor containing unsubstantiated lump sum requests for adjustment of the Contract Amount will not be considered by the Owner and Architect. The Owner and Architect will not be liable for any delay incurred by reason of the Contractor's failure to submit satisfactory justification and back-up with any request for adjustment to the Contract Amount.

§ 7.2.7 Agreement on any Change Order shall constitute a final settlement of all matters relating to the change in the initial Work which is the subject to the Change Order, including, but not limited to, all direct, indirect and impact costs associated with such change and any and all adjustment to the Contract Sum and the Construction Schedule. The Contractor will not be entitled to any compensation for additional work, impact costs or delays in the Construction Schedule not included in the Change Order.

§ 7.2.8 No additional time will be granted to the Contractor for a Change Order of less than $100,000.

§ 7.2.9 All Change Orders will be consistent with N.J.A.C. 6A:23A-21.1 and N.J.A.C. 6A:26-4.9.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect or Construction Manager and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

.1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;

.2 Unit prices stated in the Contract Documents or subsequently agreed upon;

.3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or

.4 As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in Section 7.2. In such case, and also under Section 7.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data, including such supporting and itemized data from Subcontractors. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

.1 Costs of labor shall be in accordance with the New Jersey Prevailing Wage Rates at the time of the Contract commencement with no additional "labor burden", future increases or any other considerations;

.2 Costs of materials, supplies, and equipment, whether incorporated or consumed;

.3 Rental costs of machinery and equipment, exclusive of hand tools, only when machinery or equipment is not already on site and without any compensation for Contractor or Subcontractor-owned machinery or equipment;

.4 Costs of premiums for all bonds and insurance shall be limited to 1.5%, and must be directly related to the change; and

.5 Costs of home office, supervision and field office personnel, whether directly or indirectly attributable to the change, WILL NOT BE PERMITTED UNDER ANY CIRCUMSTANCE.

§ 7.3.5 INTENTIONALLY OMITTED

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost plus the 15% combined overhead and profit as confirmed by the Architect or Construction Manager. When both additions and credits covering related Work or substitutions are involved in a change, the increase or decrease for overhead and profit shall be figured on the basis of net change with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect or Construction Manager will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect or Construction Manager determines, in the Architect or Construction Manager's professional judgment, to be reasonably justified. The Architect or Construction Manager's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect or Construction Manager concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect or Construction Manager will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 Minor Changes in the Work

The Architect and/or the Construction Manager may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's and/or the Construction Manager's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and Construction Manager within five (5) calendar days and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's and/or Construction Manager's order for a minor change without prior notice to the Architect and Construction Manager that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.3 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.2.4 Owner, in coordination with the Contractor, shall set work hours. Contractor may be required to work nights, weekends or holidays as necessary to complete the Work in accordance with the Schedule or in coordination with school activities. Under no circumstances shall the Contractor begin or continue with work that is adversely impacting School activity or operations. All utility shutdowns, interruptions, work in or adjacent to existing buildings will be coordinated through the Owner, or Construction Manager, and may have to be performed during hours when the School is not in operation. All cutting, hammering or other activity that is noisy, produces smoke or fumes or is otherwise disruptive to the School may have to be done during hours when the School is not in operation. Work required to be performed during non-school operating hours, as determined by the Owner or Construction Manager, will be performed at no additional cost to the Owner. Contractor shall ensure all work is performed at a time and in a manner that does not disrupt Owner's operations.

§ 8.2.5 Absent direction of the Owner to the contrary, Work shall proceed uninterrupted to Final Completion. The Contractor acknowledges and recognizes that the Owner is entitled to full and beneficial occupancy and use of all or part of the completed Work in accordance with the Milestone Dates set forth in other sections of the Contract Documents, as per approved Schedule, and that the Owner has made arrangements to discharge its public obligations based upon the Contractor's achieving Substantial Completion of all of the Work within the Contract Time. The Contractor further acknowledges and agrees that if the Contractor fails to complete substantially or cause the Substantial Completion of any portion of the Work as required by the Project

Construction Schedule and/or within the Contract Time, the Owner will sustain extensive damages and serious loss as a result of such failure. The exact amount of such damages will be difficult to ascertain.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) negligence, bad faith, activate interference or tortious conduct of the Owner; (2) changes ordered in the Work; or (3) other occurrences, despite Contractor's best avoidance and mitigation efforts, beyond the control and without the fault or negligence of the Contractor and as to which the Contractor has not accepted the risk elsewhere in the Contract Documents, then, provided that the Contractor is in compliance with Subparagraph 8.3.3 hereof, the Contract Time shall be extended by Change Order or Construction Change Directive for the length of time actually and directly caused by such occurrence as determined by the Architect and approved by the Contractor and Owner (such approval not to be unreasonably withheld, delayed, or conditioned); provided, however, that such extension of Contract Time shall be net of any delays caused by or due to the fault or negligence of the Contractor or which are otherwise the responsibility of the Contractor or as to which Contractor has accepted the risk elsewhere in the Contract Documents and shall also be net of any contingency or "float" time allowance included in the Contractor's construction schedule. The Contractor shall, in the event of any occurrence likely to cause a delay, cooperate in good faith with the Architect and Owner to minimize and mitigate the impact of any such occurrence and do all things reasonable under the circumstances to achieve this goal whether or not an extension of time may be available to Contractor.

§ 8.3.2 Any claim for extension of time shall be made in writing to the Architect not more than five (5) days after the delay commences or Contractor reasonably should know a delay is likely, whichever is earlier, otherwise, it shall be waived. The Contractor shall provide an estimate of the probable effect of such delay on the progress of the work. No claim made beyond the five (5) days shall be considered valid.

§ 8.3.2.1 The Contractor agrees that if any delay in the Contractor's works unnecessarily delays the work of any other Contractor or Contractors, the Contractor shall in that case pay all costs and expenses incurred by such parties due to such delays and hereby authorizes the Owner to deduct the amount of such costs and expenses from any moneys due or to become due the Contractor under this Contract. The Architect shall be responsible for ascertaining whether the Contractor is responsible for delaying any of the work of any other Contractor. His decision shall be final.

§ 8.3.3 Notwithstanding anything to the contrary in the Contract Documents, any extension of the Contract Time, to the extent permitted under Paragraph 8.3.1., shall be the sole remedy of the Contractor for any (1) delay in the commencement, prosecution or completion of the Work, (2) hindrance or obstruction in the performance of the Work, (3) loss of productivity or (4) other similar claims (collectively referred to in this Paragraph 8.3.3. as "delays"), whether or not such delays are foreseeable, subject to the limitations of N.J.S.A. 18A:18A-41. In no event shall the Contractor be entitled to any compensation or recovery of any damages in connection with any delay including without limitation consequential damages, lost opportunity cost, impact damages or other similar remuneration. The Owner's exercise of any of its rights or remedies under the Contract Documents (including without limitation ordering changes in the Work or directing suspension, rescheduling or correction of the Work) regardless of the extent or frequency of the Owner's exercise of such rights or remedies shall not be construed as an act of interference with the Contractor's performance of the Work. This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents that expressly permit same.

§ 8.3.4 The Contractor agrees that the Owner can deduct from the Contract Sum, or shall be entitled to reimbursement for, any wages or fees paid or to be paid by the Owner to any inspectors, the Architect and the Construction Manager employed by it on the Project for any number of days in excess of what would have been required had the Work timely been substantially and finally completed and that such wages and fees are determinable damages not factored into the liquidated damages set forth in the Agreement.

§ 8.3.5 Contractor accepts the risk of interruptions and delays in the Work from typical weather conditions. Where the cause of delay is due to weather conditions, an extension of time shall be granted only for unusually severe weather, as determined by reference to historical data. The term "historical data" as used in the previous sentence shall be construed to require a consideration of the five previous years of data at the location of the Project for the month in which the weather delay is claimed. Weather is unusually severe if the number of days in which weather conditions preclude the performance of the Work during the month in question exceed the average shown in the historical data for the month in question; the extension of time shall be limited to the number of days in excess of the average.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 INTENTIONALLY OMITTED

§ 9.2 Schedule of Values

Where the Contract is based on a stipulated sum, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work which in the aggregate equals that total Contract Sum, divided so as to facilitate payments to Subcontractors, supported by such evidence of correctness as the Architect may direct or as required by the Owner. It will be necessary for all Contractors to divide their contract into a separate schedule for the work performed at the project. These schedules, when approved by the Architect, Construction Manager and Owner, shall be used to monitor the progress of the Work and as a basis for Certificates for Payment. All items with entered values will be transferred by the Contractor to the "Applications and Certificate for Payment," and shall include the latest approved Change Orders and Construction Change Directives. Change Order values and Construction Change Directive values shall be broken down to show the various subcontracts. The Application for Payment shall be on AIA Document G702 and G703 and the approved Voucher obtainable from the Owner. Each item shall show its total scheduled value, value of previous applications, value of the application, percentage completed, value completed and value yet to be completed. All blanks and columns must be filled in, including every percentage complete figure . The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect.

§ 9.2.1 In addition to other elements of the Work, Contractor shall include the following separate items in its schedule of values:

Punch List Work - Minimum of 1% of contract value
Value for testing
Value for Record Drawings and manuals
Value for final clean-up and monthly value for daily clean up by the Contractor
Value for equipment start-up and commissioning
Value for shop drawings
Value for Owner's attic stock
Safety protections
Project Schedule and Monthly Updates
Winter Protection
Allowance
TAB coordination shiv, belts and modifications, as required

§ 9.3 Applications for Payment

§ 9.3.1 The Contractor shall submit to the Architect an itemized Application for Payment for their Contract on AIA Document G702 and G703 and the approved Voucher obtainable from the Owner. Payroll Certification for all employees of all of the workers on the project, including Contractor's, Subcontractors, and Sub-subcontractors, shall be submitted as well as other such data for the purposes of summarizing the Work and tracking the Project. The Architect and the Construction Manager will process the application and forward it with his recommendations to the Owner

§ 9.3.1.1 INTENTIONALLY OMITTED

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.1.3 Upon final completion, the Contractor shall submit a separate voucher for the full amount of the retainage along with the Consent of Surety, A.I.A. Form G707A, and the Contractor shall be required to furnish a Maintenance Bond for 100% of the Project Cost for a period of two (2) years from the Date of Final Acceptance.

§ 9.3.1.4 Upon final acceptance of the work performed pursuant to this Contract for which the Contractor has agreed to the withholding of payments pursuant to Article 9 of this Contract, all amounts being withheld by the Owner shall be paid in accordance with Paragraph 9.3.1.3 without further withholding of any amounts for any purposes whatsoever, provided that all obligations of the Contract Documents has been satisfactorily completed and no claims for which Contractor may have responsibility are pending or anticipated.

§ 9.3.1.5 In addition to requirements set forth elsewhere in the Contract Documents, applications for payment shall be accompanied by the following, all in form and substance satisfactory to the Owner, Architect and Construction Manager:

1. A current Contractor's lien and claim waiver and a duly executed and acknowledged sworn statement by an officer of the Contractor showing all subcontractors and materialmen with whom the Contractor has entered into subcontracts, the amount of each such subcontract, the amount requested for any subcontractor and materialmen in the requested progress payment and the amount to be paid to the Contractor from such progress payment.
2. A Subcontractor's lien and claim waiver for each Subcontractor identified in the statement referenced in the preceding paragraph.
3. A Purchase Order or Voucher if required by the Owner.
4. A Schedule Update approved by the Construction Manager and Architect.
5. A Third Party (not the General Contractor) written Field Safety Inspection Report.
6. An updated Shop Drawing Log showing the status of all of the required Shop Drawings.

§ 9.3.2 Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with Sections 9.3.2.1, 9.3.2.2, 9.3.2.3 and 9.3.2.4 and satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site. The Contractor shall store the off-site materials and equipment in a secure, bonded warehouse.

§ 9.3.2.1 With each Application for Payment the Contractor shall submit to the Architect and Owner a written list identifying each location where materials are stored off the Project site and the value of materials at each location. The Contractor shall procure insurance satisfactory to the Owner for materials stored off the Project site in an amount not less than the total value thereof.

§ 9.3.2.2 The consent of any surety shall be obtained to the extent required prior to the payment for any materials stored off the Project site.

§ 9.3.2.3 Owner, Architect and Construction Manager shall have the right to make inspections of the off-site storage areas at any time.

§ 9.3.2.4 Materials stored off site shall be protected from diversion, destruction, theft and damage to the satisfaction of the Owner, shall specifically be marked for use on the Project and shall be segregated from other materials at the storage facility.

§ 9.3.3 The Contractor warrants and agrees that title to all Work will pass to the Owner either by incorporation in the construction or upon receipt of payment therefor by the Contractor, whichever occurs first, free and clear of all liens, claims, security interests, or encumbrances whatsoever, that the vesting of such title shall not impose any obligation on Owner or relieve Contractor of any of its obligations under the Contract, that the Contractor shall remain responsible for damages to or loss of the Work, whether completed or under construction, until responsibility for the Work has been accepted by Owner in the manner set forth in the Contract Documents, and that no Work covered by an Application for Payment will have been acquired by the Contractor, or by any other person performing Work at the site or furnishing materials and equipment for the Project, subject to an agreement under which an interest therein or an encumbrance thereon is retained by the seller or otherwise imposed by the Contractor or such other person.

§ 9.3.4 The Owner will issue timely payments to the Contractor in accordance with the requirements of "The Prompt Payment Act", N.J.S.A. 2A:30A-1, et seq. The Contractor is hereby notified that the Owner, as a public entity, requires all payments to be approved at scheduled public Board of Education meetings. The vote on authorization for payments will be made at the first public meeting of the Board, following the Board's receipt of the Architect's authorization for payment, and paid during the subsequent payment cycle.

Typically, the Owner has monthly public business meetings. Provided an Application for Payment is received by the Architect not later than the date required by the Owner, and upon issuance of a Certificate of Payment for all or part of the Application for Payment, the Owner shall make payment to the Contractor not later than the tenth (10th) day after the Owner's regular public meeting held during the following month. If an Application for Payment is received by the Architect after the application date fixed above, payment shall be made by the Owner not later than ten (10) calendar days after the next regular public meeting of the Owner held after the late submitted Application for Payment has been reviewed and certified for payment by the Architect.

§ 9.3.4.1 Certification shall be subject to Consent of Surety presented by the Contractor for each application.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within Fourteen days after receipt of the Contractor's Application for Payment, either (1) issue to the Construction Manager a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Construction Manager a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor, Owner and Construction Manager of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect or Construction Manager may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- .1 defective Work not remedied;
- .2 third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
- .3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;
- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .5 damage to the Owner or a Separate Contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay;

.7 repeated failure to carry out the Work in accordance with the Contract Documents;
.8 avoidable delay in the progress of the Work;
.9 delay in the submission for approval of the names of Subcontractors, materialmen, sources of supply, shop drawings, samples, or other submittals'
.10 failure to maintain the Project Site in a clean, safe and satisfactory condition in accordance with good construction practices as recommended by the Architect after consultation with the Contractor and Construction Manager;
.11 failure to submit updates as required by the Owner or as required by the Contract Documents;
.12 failure of the Contractor to comply with mandatory requirements for maintaining record drawings. The Contractor shall be required to check record drawings each month. Written confirmation that the record drawings are up-to-date shall be required by the Architect before approval of the Contractor's monthly payment requisition will be considered;
.13 failure of Contractor to provide a third-party Insurance Safety Site Inspection Report monthly and remedy all issues promptly;
.14 reasonable evidence that a legal impediment has arisen or can reasonably be expected to arise that would preclude the Contractor from completing the Work, timely or otherwise; or
.15 Failure to cooperate with Owner, Construction Manager or Architect relative to construction schedule, material storage, coordination with the Owner, clean up or safety.

§ 9.5.2 INTENTIONALLY OMITTED

§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.4 If the Architect or Construction Manager withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and Construction Manager and the Contractor shall reflect such payment on its next Application for Payment.

.1 If the Contractor disputes any determination by the Architect with regard to any Certificate of Payment, the Contractor nevertheless expeditiously shall continue to prosecute the Work.
.2 The failure of the Owner to retain any percentage payable to the Contractor or any change in or variation of the time, method or condition of payments to the Contractor shall not release or discharge to any extent whatsoever the Surety upon any bond given by Contractor hereunder. The Owner shall have the right, but not the duty, to disregard any schedule of items and costs that the Contractor may have furnished and defer or withhold in whole or in part any payment if it appears to the Owner, in its sole discretion, that the balance available in the Contract Sum as adjusted and less retained percentages, may be insufficient to complete the Work.
.3 The Contractor agrees that the time and conditions for payment under the Contract shall be as stated in the Contract Documents. The Contractor specifically agrees that Owner's failure to give, or timely give, notice of:

.1 any error in an invoice or application for payment submitted by the Contractor for payment;
.2 any deficiency or non-compliance with the Contract Documents with respect to any Work for which payment is requested, shall not waive or limit any of the Owner's rights or defenses under the Contract Documents, or require the Owner to make a payment in advance of the time, or in an amount greater than, as provided by Contract Documents; or
.3 The Contractor shall make payments to its Subcontractors in accordance with the provisions of any applicable law governing the time, conditions, or requirements for payment to its Subcontractors, and shall comply with the provisions of any such law. The Contractor and its Surety shall indemnify and defend the Owner any loss, cost, expenses, or damages including attorney's fees, arising from or relating to the Contractor's failure to comply with such law.

.4 The Contractor shall make payments to its Subcontractors in accordance with the provisions of any applicable law governing the time, conditions, or requirements for payment to its Subcontractors, and shall comply with the provisions of any such law. The Contractor and its Surety shall indemnify and

defend the Owner any loss, cost, expenses, or damages including attorney's fees, arising from or relating to the Contractor's failure to comply with such law.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect. Notwithstanding Certification by the Architect, the Owner may refuse to make payment based on any default by the Contractor including, but not limited to those defaults set forth in Section 9.5.1. The Owner shall not be deemed in default by reason of withholding payment while any of such defaults by the Contractor remain uncured.

§ 9.6.2 If a Subcontractor has performed in accordance with the provisions of its Contract with the Contractor and the Work has been accepted by the Owner, the Owner's authorized approving agent, or the contractor, as applicable, and the parties have not otherwise agreed in writing, the Contractor shall pay to its Subcontractor within 15 calendar days of the receipt of payment from the Owner, the full amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor.

§ 9.6.8 INTENTIONALLY OMITTED

§ 9.7 Failure of Payment

If the Owner does not pay the Contractor as required by "the Prompt Payment Act" and the amount is not subject to a good faith dispute; does not provide a written statement of the amount withheld and the reason for the withholding; and the Owner is not engaged in a good faith effort to resolve the reason for the withholding, then the Contractor may, upon seven calendar days' written notice to the Owner, stop the Work, without penalty for breach of contract, until payment of the amount owing has been received. The Contract Time shall be extended appropriately. amounts not subject to a good faith dispute

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof which the Owner agrees to accept separately is sufficiently complete in accordance with this definition and the Contract Documents so that the Owner can occupy or utilize the Work for its intended use. The Work will not be considered substantially complete until all project systems included in the Work are operational as designed and scheduled, all designated or required inspections, certifications, permits, approvals, licenses and other documents

from any governmental authority having jurisdiction thereof necessary for the beneficial use and occupancy of the Project are received, designated instruction of Owner's personnel has been completed, and all final finishes within the Contract are in place. In general, the only remaining Work shall be minor in nature, so that the Owner can occupy the building on that date and the completion of the Work by the Contractor would not materially interfere or hamper the Owner's (or those claiming by, through or under the Owner) normal operations. Contractor recognizes that normal operations require the use and occupancy of the Work by students and faculty without interruption and that any punchlist or corrective work shall be done at times when the Work is not so occupied. As a further condition of substantial completion acceptance, the Contractor shall certify that all remaining Work will be completed within thirty (30) consecutive calendar days following the date of substantial completion. In addition to any other definitions of Substantial Completion as defined by the contract documents, the following is required before the project is considered "Substantially Complete":

.1 All required final inspections have been completed by the authority having jurisdiction resulting in a TCO or CO.

.2 Air Balancing Reports: Reports can be handwritten field notes but must be reviewed and approved via the shop drawing process by the Mechanical Engineer. Final Air and Water Balancing Reports certified by the licensed balancer are required for "Final Acceptance" and the start of the warranty period. (These reports must be submitted in accordance with the shop drawing process to the Architect so that they can be tracked and approved and distributed to all applicable parties).

.3 Equipment Start Up Reports: Reports can be handwritten field notes but must be reviewed and approved via the shop drawing process by the Mechanical Engineer. (These reports must be submitted in accordance with the shop drawing process to the Architect so that they can be tracked and approved and distributed to all applicable parties).

.4 Owner On-site ATC Training: Refer to the ATC specifications for training requirements on-site and off-site. The Owner does not have beneficial use of the mechanical system until they can operate it following this training.

.5 Completion of Commissioning: Refer to the Start-up and Adjustment specifications. This process will require the Owner's Operator, Construction Manager and the Mechanical Engineer on site to witness a demonstration and operation of every mechanical device. The devices shall be operated from the on-site Owner's ATC Computer and verified by the Mechanical Contractor's field personnel to confirm proper operation. In addition to this demonstration, the contractor shall demonstrate Owner required maintenance of all mechanical equipment to maintain the manufacturer's warranty. This should include but not be limited to belt tension/adjustments, filters, etc. Please schedule several days for the commissioning process.

.6 Written certification from a qualified AHC (Certified Architectural Hardware Consultant) that the hardware, cores and keying has been installed and tested in every door and is 100% complete for each phase or the total project whichever comes first.

.7 Provide a Fire Alarm System NFPA Record of Inspection and Testing Certification Form.

§ 9.8.2 "PUNCH LIST": When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items "PUNCH LIST" to be completed or corrected along with all special warranties required by the Contract Documents endorsed by the contractor prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.2.1 The Contractor shall perform a Quality Control / Quality Assurance QC/QA Punchlist of all work prior to requesting Substantial Completion and a punch list from the Construction Manager and Architect. The Contractor's Project Manager shall take the lead and conduct an onsite review with the Contractor's superintendent and representation from every Prime Subcontractor. Notification of this onsite walk thru shall be provided in writing to Construction Manager, Architect and Owner who may or may not choose to attend. The Contractor's Project Manager shall record and distribute this QC/QA Punchlist in a matrix that provides an additional column for the Contractor to document the completion of the work and the date. After successful completion of the Contractor's QC/QA Punchlist and all work, the Contractor shall request the Construction Manager and Architect perform a Punchlist. Substantial Completion shall be requested in accordance with paragraph 9.8.1.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not

included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents and the requirements above so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit in writing a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.4.1 The Architect's Certificate of Substantial Completion shall be subject to the Owner's final approval.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate.

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.
§ 9.9.3 Partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.9.4 The occupancy of any portion of the Work shall not constitute acceptance of any Work, except as hereinafter stated, nor does it waive the Owner's right to Liquidated Damages or any other legal or equitable rights. Final Acceptance of the Work shall be for the whole Work only and not part.

§9.9.5 As portions of the Project are completed, and occupied, Contractor shall ensure the continuing construction activity will not unreasonably interfere with the use, occupancy and quiet enjoyment of the completed portions thereof.

.1 The Contractor agrees to coordinate the Work with the Architect and the Owner in order to minimize disturbance to occupied portions of the structure.

.2 In the event performances or scheduled events by the Owner are conducted in close proximity to the Work in progress, the Contractor agrees to cease all work which may disturb the Owner's occupants at the site.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed

in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled. All warranties and guarantees required pursuant to the Contract Documents shall be assembled and delivered by the Contractor to the Owner as part of the final application for payment. The final Certificate for Payment will not be issued by the Architect until all warranties and guarantees and Maintenance Bond have been received and accepted by the Owner.

§ 9.10.1.1 The Architect's Certificate of Final Completion shall be subject to the Owner's final approval.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, (6) as-built drawings, and (7) evidence of compliance with all requirements of the Contract Documents: notices, certificates, affidavits, other requirements to complete obligations under the Contract Documents: including but not limited to (a) instruction of Owner's representatives in the operation of mechanical, electrical, plumbing and other systems, (b) delivery of keys to Owner with keying schedule: master, sub-master and special keys, (c) delivery to the Construction Manager of Contractor's General Warranty (as described in Paragraph 3.5) and each written warranty and assignment thereof prepared in duplicate, certificates of inspections, and bonds for the Construction Manager's review and delivery to Owner, (d) delivery to the Construction Manager a printed or typewritten operating, servicing, maintenance and cleaning instructions for all Work; parts lists and special tools for mechanical and electrical Work, in approval form, (e) delivery to the Construction Manager of specified Project record documents, (f) delivery to Owner of a Final Waiver of Liens (AIA Document G-706 or other form satisfactory to Owner), covering all Work including that of all Subcontractors, vendors, labor, materials and services, executed by an authorized officer and duly notarized (g) delivery to the Owner of the Maintenance Bond. In addition to the foregoing, all other submissions required by other articles and paragraphs of the Specifications including final construction schedule shall be submitted to the Architect before approval of final payment. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.1.1

.1 The Contractor must fully comply with the job safety requirements in addition to all Federal, State and Local safety guidelines. All costs associated with complying with all safety requirements shall be included in the Contractor's base bid.

.2 The Contractor will serve as the overall Project Safety Coordinator and shall be responsible for all issues of safety and protection. The Contractor shall designate a safety person at the job site while the Contractor is working on the project site. The designated safety person shall be responsible for the safety of their work and for their workers and to make continuous inspections for all safety issues relating to his work. The Architect and/or the Construction Manager are not responsible for safety on this project but will endeavor to promote safety. Contractor must comply with job Safety Requirements in addition to OSHA and local agency requirements. Failure to comply with safety requirements will be grounds for withholding of payments.

.3 Contractor will comply with all reasonable requests of the Owner and Construction Manager with respect to additional security and protections required for work interfacing with Facility Operations. Safety is of utmost importance on this project and all issues relative to safety and protection of the Facility, Staff and Occupants will be treated as emergency needs and will not be subject to the 7-day notice requirements of Article 14.

.1 The Contractor shall provide, maintain, relocate and remove in coordination the Construction Manager, a 6' high, perimeter security fence. Fence will surround the building or relevant portions thereof and proposed parking areas and will have signage attached at 100' intervals advising "Construction Area – Please Keep Out". The Contractor to be responsible for opening and securing site each day.

.2 Orange safety fencing will be installed around the entire area of any and all earthwork, excavations, etc. and will be maintained until the work is complete.

.3 This is a hard hat job. Identifying hard hats shall be worn at all times.

.4 Hot work permits will be issued by foreman for all activities involving open flames.

.4 The proper execution of the required safety provisions is directly related to the general condition safety line item on the schedule of values. The failure to provide a competent person on site to properly identify and take immediate corrective action may result in deductions to the general condition safety line item of the schedule of values.

.5 The Contractor shall be responsible for the immediate investigation and resolution of all safety and environmental complaints / issues generated by contractor employees, owners, owner's representatives or members of the public.

.6 Contractor shall maintain all egress routes throughout building. Contractor shall post exit signs as coordinated with the Construction Manager. Contractor shall provide wall hung fire extinguishers throughout building as deemed necessary by the Construction Manager and fire officials.

.7 Contractor's safety representative shall perform a daily safety inspection walk through to ensure that all requirements of the OSHA Standards, Fire Protection Standards and Safe Work Practices are being with and/or corrected. The responsibility of the Contractor is to provide a safe and healthy work environment for construction personnel, Owner's personnel and representative, and the public.

.8 Upon written receipt of safety concerns and /or issues, the Contractor shall respond in writing addressing how the safety concerns or issues were resolved. The Construction Manager shall be copied on all safety-related correspondence.

.9 The Contractor's response and compliance with correction of deficiencies noted in the safety concerns notice issued by the Authority having jurisdiction is mandatory. Failure to comply will be grounds for withholding of progress payments until the conditions are acceptable to OSHA or Authority having local jurisdiction.

.10 The Contractor shall submit to the Construction Manager, a copy of all licenses (welding, power nailers, asbestos, etc.) as required by applicable agencies.

.11 Contractor shall have all required personal protective equipment and materials available for use by each employee as required by Federal, State and Local guidelines.

.12 Contractor shall supply proper equipment and crew sizes as necessary to safely complete the work.

.13 Contractor shall provide documented safety training for each of their employees and subcontractor's employees no later than the first day they arrive on site. The training shall be documented and signed

by the trainer and employee. A copy of all safety-training documents is to be provided to the Owner and updated as manpower loading increases.

.14 The Contractor shall supply (2) two OSHA approved means of access/egress to each floor and roof for the course of the entire project for use by all applicable parties. The Contractor shall erect and maintain OSHA approved pedestrian walking bridges, for emergency access/egress and as necessary to protect personnel from overhead work.

.15 The Contractor shall be responsible for providing and maintaining all temporary emergency egress routes. The Contractor shall obtain the approval of the Building and Fire Departments for all temporary emergency egress routes. The Contractor shall provide for fire separation walls between occupied areas as required by local officials.

.16 The Contractor shall provide, relocate and /or maintain barricades, signage, provide flagmen etc. as necessary to ensure public safety and safe egress.

.17 The Contractor shall notify the Construction Manager immediately upon arrival of OSHA inspector/representative to the site.

.18 The Contractor shall submit to the Construction Manager all MSDS sheets and shall cooperate in the posting of all required notifications relative to the use of hazardous substances on the property. Contractor to comply with New Jersey law regarding the use or storage of hazardous substances in Schools. MSDS sheets shall be posted prior to product being delivered to site.

.19 The Contractor, Subcontractors, vendors, etc. must enforce a no smoking, vaping or alcohol use policy for all employees during the entire course of the project. Any worker found violating these restrictions, or being belligerent, will be subject to removal from the site at the sole discretion of Owner.

.20 The Contractor shall be responsible to secure the site at the end of each workday by an effective means and maintain same until all parties determine same is no longer required.

.21 For the safety of occupants, staff, and the public, the steel erection must be scheduled and coordinated with the Construction Manager. Swinging of steel and crane boom over occupied space will not be allowed. Steel Subcontractor shall provide additional barricades and fencing around his crane and steel at all times.

.22 The Contractor must submit an acceptable OSHA compliant site specific written safety plan to the Construction Manager prior to mobilizing on site. The written safety plan shall include (as applicable to their work) but is not limited to the following:

- No smoking, vaping or alcohol use is allowed on the project, including while away from the site if the worker will go to or return to the site that day. Any worker found violating these restrictions, or being belligerent, will be subject to removal from the site. (Contractors shall post required signs).
- Full time hard hat policy (identifying hard hats shall be worn at all times).
- Site specific emergency action plan with contractor phone numbers, active 24 hours a day, 7 days a week.
- Competent on-site safety representative, named and active (Provide alternate)
- Scaffold erection plan, including a log of daily inspections.
- Full time fall protection plan for exposures over 6'-0".
- Job site signage plan (Perimeter fence warning signs posted 50'-0" o/c.
- First aid and CPR provisions.
- OSHA 200 log and Job Safety and Health Protection poster.
- Daily clean up.
- Hazard Communication Program with MSDS logged and maintained.
- Daily diary of work, issues, and incident, etc.
- Sheeting, shoring and excavations protection line.
- GFI safety program.
- Hazardous Energy Control Lock out tag out program.
- Required safety clothes; Eye & ear protection, respirators, boots, belts, gloves etc. as appropriate to their work requirement.
- Fire Extinguishers.
- Removal guard rail and protection at material loading areas, 200lb force minimum requirement.
- All stairs and platforms must have railings, 200lb force minimum requirement. Stair pains and landings must be filled prior to their use.
- Daily inspection of tools and equipment; verify safety devises are operational.
- Ladder usage plan.

- Weekly toolbox meetings, documented and signed by each employee
- Temporary heat procedures.

.23 The Contractor shall maintain and submit a complete copy of the written safety plan, logs, diaries, plans and programs on site for the project files.

.24 The Contractor shall provide a third-party Insurance Safety Site Inspection Report monthly and remedy all issues promptly.

.25 The speed limit within the project property is 5 MPH. Contractor employees operating vehicles in excess of the speed limit or in any otherwise unsafe manner will be directed to leave the site and not permitted to return.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

.1 employees on the Work and other persons who may be affected thereby;

.2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and

.3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction as well as any other real or personal property of the Owner.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

§ 10.2.2.1 It is the Contractor's responsibility to determine the existence of potentially hazardous materials, including lead, and to protect his workmen and the work area.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable directly to grossly negligent acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 Injury or Damage to Person or Property
If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.2.9 The Contractor shall provide and maintain in good operating condition suitable and adequate fire protection equipment and shall comply with all reasonable recommendations regarding fire protection made by the representatives of the fire insurance company carrying insurance on the Work or by the local fire chief or fire marshal.

§ 10.2.10 The Contractor shall remove snow or ice which may accumulate on the site within areas under his control which might result in damage or delay.

§ 10.2.11 The Contractor shall take all precautions necessary to prevent loss or damage caused by vandalism, theft, burglary, pilferage, or unexplained disappearance of property of the Owner and Contractor, whether or not forming part of the Work, located within those areas of the Project to which the Contractor has access. Whenever unattended, including nights and weekends, mobile equipment and operable machinery shall be kept locked and made inoperable and immovable.

§ 10.2.12 Neither the Owner nor the Construction Manager nor the Architect shall be responsible for providing a safe working place for the Contractor, the Subcontractors or their employees, or any individual responsible to them for the work.

§ 10.2.13 When all or a portion of the Work is suspended for any reason, the Contractor shall securely fasten down all coverings and protect the Work as necessary from injury or any cause.

§ 10.2.14 The Contractor shall promptly report in writing to the Owner, Construction Manager and Architect all accidents arising out of or in connection with the Work which caused death, personal injury or property damage giving full details and statements of any witnesses. In addition, if death, serious personal injury or serious property damage is caused, the accident shall be reported immediately by telephone or messenger to the Owner, Construction Manager and Architect.

§ 10.2.15 Contractor is required to follow and enforce the work rules set forth below in addition to other rules set forth in the Contract Documents. Failure to comply with or enforce any of these rules will be grounds for suspension and/or termination of this Contract:

.1 Anyone found impaired will be escorted from the Project site.
.2 No use of illegal drugs or prescription medications which could induce drowsiness or otherwise impair perception or performance. Use of illegal drugs may result in prosecution to the fullest extent of the law. Any warning associated with use of prescription drugs must be complied with, particularly warning against operation of machinery and equipment.
.3 No horseplay or rough housing will be allowed.
.4 No sexual, racial, or ethnic harassment, or similar conduct will be tolerated.
.5 All employees shall use proper sanitation habits including use of toilet facilities and garbage cans.
.6 All employees shall dress in clothing appropriate for the work they are to perform. All personnel are to wear hardhats, safety shoes, glasses, gloves, masks or respirators, noise protection devices, and other protective clothing and equipment as required by OSHA standards.
.7 All equipment is to be properly stored and/or secured at the end of the workday or if it is to remain idle for greater than one hour.
.8 All personnel are to be made aware of the availability of Material Safety Data Sheets for materials used at the Project site. This information is available from the Contractor using the product. The Contractor shall maintain a copy of all MSDS forms at the construction site office for all personnel to review.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner, Construction Manager and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor, Construction Manager and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor, Construction Manager and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor, Construction Manager or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor Construction Manager and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up adjustments shall be accomplished as provided in Article 7.

§ 10.3.3 INTENTIONALLY OMITTED

§ 10.3.4 INTENTIONALLY OMITTED

§ 10.3.5 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

§ 10.3.7 Prior to bringing any fill material (such as topsoil, engineered fill, DGA, tire scrub at the construction entrance, etc.) onto the project site, the Contractor must have the material tested and certified to be clean and free from any hazardous material. Provide this information per the submittal requirements via a shop drawing.

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

§ 10.4.1 – EMERGENCY/SAFETY PLAN

All parties involved in the construction process should be aware of emergency services that may be required during the construction process.

Contractor shall establish the site-specific Emergency Action Plan and, after approval by the Owner, and local authorities, shall display at site trailers and various locations at the site.

In case of an accident, emergency, or injury on the job site, the Contractor shall immediately follow the Site-Specific Emergency Action Plan. Following the incident, the Contractor shall submit to the Construction Manager a complete

written accident report detailing the circumstances which caused the accident, extent of injuries, damage to the building, time of accident, corrective action required, etc.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

All insurance provisions shall be confirmed with the Owner's Insurance Agent.

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located and such company shall be rated at least A- by A.M. Best.

§11.1.1.1 The Owner and Construction Manager shall be included as additional insured in all places where Architect is named. Contractor shall, without in any way altering Contractor's liability under the Contract or applicable law, obtain, pay for and maintain insurance for the coverages and amounts of coverage not less than those set forth below in the Schedule of Insurance Coverages and shall provide to Owner certificates issued by insurance companies satisfactory to Owner to evidence such coverage no later than 7 days of the date of the execution of the Agreement and prior to any personnel or equipment being brought onto and/or before any work commences at the job site. The coverage afforded under any insurance obtained pursuant to this paragraph shall be primary to any valid and collectible insurance carried separately by any of the indemnities. Such certificates shall provide that there shall be no cancellation, non-renewal or material change of such coverage without thirty (30) days prior written notice to Owner. In the event of any failure by Contractor to comply with the provisions of this Article 11, Owner may, at its option, on notice to Contractor, suspend the Contract for cause until there is full compliance with this Article 11 and / or terminate the Contract for cause. Alternatively, Owner may on twenty-four hour's notice purchase such insurance at Contractor's expense, provided that Owner shall have no obligation to do so, and if Owner shall do so, Contractor shall not be relieved of or excused from the obligation to obtain and maintain such insurance amounts and coverages. Contractor shall provide to Owner a copy of any and all applicable insurance policies. The Owner, Construction Manager, Architect, other Indemnitees referenced in Section 3.18, the State of New Jersey and the New Jersey Department of Education shall be named as additional insured on a primary and non-contributory basis on all Insurance Policies to be provided by the Contractor, with a provision in each Policy requiring the insurer(s) providing coverage to notify the additional insured at least 30 days in advance of any change to or cancelation of coverage, as mentioned above.

§ 11.1.1.2 Schedule of Insurance Coverages

.1 Commercial General Liability, Each Occurrence

a.	Each Occurrence:	$ 1,000,000.00
b.	Damage to Rented Premises:	$ 300,000.00
c.	Medical Expense (Any one person):	$ 15,000.00
d.	Personal & Adv Injury:	$ 1,000,000.00
e.	General Aggregate:	$ 2,000,000.00
f.	Products – Comp/Op Agg:	$ 2,000,000.00

.2 Automobile Liability: (Hired autos, scheduled autos, non-owned autos)

a.	Combined Single Limit (each accident):	$ 1,000,000.00

.3 Workers Compensation and Employers Liability:

a. WC Statutory Limits:

1.	E.L. Each Accident:	$ 1,000,000.00
2.	E.L. Disease – Each Employee:	$ 1,000,000.00
3.	E.L. Disease – Policy Limit:	$ 1,000,000.00

.4 Builder's Risk Insurance: The Contractor shall provide Builder's Risk Insurance for all risk of physical loss or damage to the property described in the Contract Documents in an amount equal to the Total Project Value, excepting excavations, foundations and other structures customarily excluded by such insurance. The Builders Risk Policy is to include coverage for the perils of Earthquake, Flood, Full Windstorm, Equipment Breakdown and Theft (excluding employee theft), contain an endorsement allowing permission to occupy and include coverage for both transit and offsite storage. In addition to the other additional named insured requirements set forth in this Article 11, the policy is also to include all contractors, subcontractors and sub-subcontractors as Additional Named Insureds on a primary and non-contributory basis. The contractor and all subcontractors are responsible for all policy deductibles and uninsured or underinsured losses, notwithstanding the cause of the loss.

.5 Contractual liability insurance applicable to the Contractor's obligations under Section 3.18.

.6 Workers' Compensation Insurance of not less than statutory limits.

.7 Completed Operations Insurance written to the limits specified for liability insurance specified under subparagraph .1 above. Coverage shall be required from the date of the start of Beneficial Occupancy until one year after the issuance date of Final Certificate for Payment.

.8 Certificates of insurance must be submitted on the ACORD Form, Certificate of Insurance. The Contractor's ACORD Certificate of Insurance must state "Contractual Liability Included" or it will be rejected.

.9 The Contractor shall either

.1 require each of its Subcontractors to procure and to maintain during the life of their subcontracts, Subcontractor's Public Liability and Property Damage, of the type and in the same amounts as specified in the preceding paragraph; or

.2 insure the activities of their Subcontractors under their respective policies.

§ 11.1.2 The Contractor shall provide surety bonds for the entire contract amount of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.1.5 Contractor shall furnish a Performance and Payment Bond in the form required by the Contract Documents, without limitation complying with the following specific requirements:

.1 The bonds shall be executed by a responsible surety licensed in the State of New Jersey Best's rating of no less than A-/X and shall remain in effect for a period of not less than two years following the date of final acceptance or the time required to resolve any items of incomplete or inadequate work and the payment of any disputed amounts, whichever time period is longer;

.2 The Contractor shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of his power of attorney indicating the monetary limit of such power;

.3 A rider including the following provisions shall be attached to each bond:

(1) Surety hereby agrees that it consents to and waives notice of any addition, alteration, omission, change or other modification of the Contract Documents. Any other alterations, change, extension of time or other modification of the Contract Documents or a forbearance on the part of either the Owner or the Contractor to the other shall not release the surety of its obligations hereunder and notice to surety of such matter is hereby waived.

(2) Surety further agrees that in the event of any default by the Owner in the performance of the Owner's obligations to the Contractor under the Contract, the Contractor or surety shall cause written notice of such default (specifying said default in writing) to be given to the Owner, and the Owner shall have 30 days after receipt of such notice within which to cure such default of such additional reasonable time as may be required if the nature of such default is such that it cannot be cured within 30 days. Such notice of default shall be sent by certified or registered U.S. mail, return receipt requested, first class postage prepaid to the Owner, Construction Manager and Architect.

§ 11.1.6 If any of the foregoing insurance coverages are required to remain in force after final payment, including, but not limited to coverage for completed operations, an additional certificate evidencing continuation of such coverage shall be submitted with the Final Application for Payment.

§ 11.1.7 In no event shall any failure of the Owner to receive certificates of policies or the policies themselves required under Paragraph 11.1 or to demand receipt of such certificates or policies prior to the Contractor commencing Work be construed as a waiver of the Owner or the Architect of the Contractor's obligations to obtain insurance pursuant to this Article 11. The obligation to procure and maintain any insurance required by this Article 11 is a separate responsibility of the Contractor and independent of the duty to furnish a certificate of such insurance policies or the policies themselves.

§ 11.1.8 When any required insurance due to the attainment of a normal expiration date or renewal date shall expire the Contractor shall supply the Owner with certificates of insurance and amendatory riders or endorsements that clearly evidence the continuation of all coverage in the same manner, limits of protection and scope as was provided by the previous policy. In the event, any renewal or replacement policy for whatever reason obtained or required is written by a carrier other than that with whom the coverage was previously placed or the subsequent policy differs in any way from the previous policy, the Contractor shall also furnish replacement policy unless the Owner provides the Contractor with prior written consent to submit only a certificate of insurance for any such policy. All renewal and or replacement policies shall be in form and substance satisfactory to the Owner and written by carriers acceptable to the Owner.

§ 11.1.9 The Contractor shall cause each Subcontractor to (1) procure insurance in the amounts set for in Article 11 and (2) name the persons referenced in Section 11.1.1.1 as additional insureds under the Subcontractor's comprehensive general liability policy. The additional insured endorsement included on the Subcontractor's comprehensive general liability policy shall state that coverage is afforded the additional insureds with respect to claims arising out of operations performed by or on behalf of the Contractor. If the additional insureds have other insurance which is applicable to the claims, such other insurance shall be on an excess or contingent basis. The amount of the insurance liability under this insurance policy shall not be reduced by the existence of such other insurance.

§ 11.1.10 Property insurance provided by the Owner shall not cover any tools, apparatus, machinery, scaffolding, hoists, forms, staging, shoring, or other similar items commonly referred to as construction equipment which may be on the site and the capital value of which is not included in the work. The Contractor shall make its own arrangements for any insurance it might require on such construction requirement.

§ 11.1.11 The Contractor may carry whatever additional insurance he deems necessary to protect itself against hazards not covered for theft, collapse, water damage, materials and equipment stored on the site, and for materials and equipment stored off site, and against loss of owned or rented capital equipment and tools owned by mechanics or any tools, equipment, scaffolding, staging, towers and forms owned or rented by the Contractor, the capital value of which is not included in the cost of the Work.

§ 11.1.12 All insurance coverage procured by the Contractor shall be provided by insurance companies having policy holder ratings no lower than "A-" and financial rating no lower than, "X" in the Best's Insurance guide, latest edition in effect as the date of the Contract and subsequently in effect at the time of the renewal of the policies required by the

Contract Documents.

§ 11.1.13 If the Owner or the Contractor is damaged by the failure of the other party to purchase or maintain insurance required under Article 11, then the party who failed to purchase or maintain the insurance shall bear all reasonable costs (including attorney's fees and court and settlement costs) properly attributable thereto.

§ 11.1.14 The Contractor and Subcontractors must remove all "X, C & U" exclusions from their policies.

§ 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. Property insurance provided by the Owner shall not cover any tools, apparatus, machinery, scaffolding, hoists, forms, staging, shoring, and other similar items commonly referred to as construction equipment that may be on the site and the capital value of which is not included in the Work. The Contractor shall make its own arrangements for any insurance it may require on such construction equipment.

§ 11.2.2 Failure to Purchase Required Property Insurance. If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance. Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

§ 11.3 INTENTIONALLY OMITTED

§ 11.4 INTENTIONALLY OMITTED

§11.5 INTENTIONALLY OMITTED

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time or Contract Sum.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense. If prior to the date of Substantial Completion, the Contractor, a Subcontractor or anyone for whom either is responsible, uses or damages any portion of the Work, including without limitation, mechanical, electrical, plumbing and other building systems, machinery, equipment or other mechanical device, the Contractor shall cause each such item to be restored to "like new condition" at no expense to the Owner.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.I, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

.1 The obligations under Section 12.2 shall cover any repairs and replacement to any part of the Work or other property caused by the defective Work.

.2 Upon completion of any work under or pursuant to Section 12.2., the two-year correction period in connection with the work requiring correction shall be renewed and recommenced.

§ 12.2.2.2 The two-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the two-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct Work which found to be defective or otherwise warranted within the two-year period, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made. This paragraph relates exclusively to the knowing acceptance of nonconforming work by the Owner. It has no applicability

to work accepted by the Owner, Construction Manager or Architect without the knowledge that such work fails to conform to the requirements of the Contract Documents.

§ 12.3.1 The Contractor and its Surety guarantee to make good, repair and/or correct, at no cost or expense to the Owner, any and all latent defects hereafter discovered, provided only that notice in writing, shall be given by the Owner to the Contractor within two years of the discovery of such defects.

.1 This obligation shall survive the termination of any or all other obligation or obligations under the Contract Documents and it is agreed by the Contractor and its Surety that in the event the Owner is required to bring suit under this provision against the Contractor or its Surety to enforce this obligation, the contractor and its Surety hereby waive any defense of the status of limitations.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The governing law shall be the law of the State of New Jersey without respect to the conflict of law principles thereof. The parties consent to exclusive jurisdiction in the Superior Court of New Jersey venued in Salem County, New Jersey, unless claims fall under exclusive jurisdiction of federal courts and such claims shall be brought in the District Court of New Jersey, Camden Division.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 INTENTIONALLY OMITTED

§ 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be cumulative and in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law or equity.

§ 13.3.2 No action or failure to act by the Owner, Construction Manager, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

§ 13.4 Tests and Inspections

§ 13.4.1 The Owner shall provide and contract for "structural tests and special inspections" as required by the NJ DCA Bulletin 03-5. The Contractor shall coordinate, schedule, and provide on-site supervision and manpower to facilitate the testing. All other tests, inspections and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. The Contractor shall give the Architect and Construction Manager timely notice of when and where tests and inspections are to be made so that the Architect and Construction Manager may be present for such procedures. The Owner shall bear costs of (1) tests, inspections or approvals that do not become requirements until after bids are received or negotiations concluded, and (2) tests, inspections or approvals where building codes or applicable laws or regulations prohibit the Owner from delegating their cost to the Contractor. The Construction Manager, Architect, Owner and Contractor shall be afforded a reasonable opportunity to attend, observe, and witness all inspections and tests of the Work. The Construction Manager, Architect or Owner may at any time request and receive from the Contractor satisfactory evidence that materials, supplies or equipment are in conformance with the Contract Documents. The Conduct of any inspection of test and the receipt of any approval shall not operate to relieve the Contractor from its obligations under the Contract Documents unless specifically so stated by Owner in writing.

§ 13.4.2 If the Architect, Owner, Construction Manager or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect and Construction Manager of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Construction Manager and Architect's services and expenses, shall be at the Contractor's expense. The Contractor also agrees that the cost of testing services required for the convenience of the Contractor in his scheduling and performance of the Work and the cost of testing services related to remedial operations performed to correct deficiencies in the Work shall be borne by the Contractor.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect and Construction Manager.

§ 13.4.5 If the Architect or Construction Manager is to observe tests, inspections, or approvals required by the Contract Documents, the Architect and Construction Manager will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.5 Interest

§ 13.5.1 The Contractor shall not be entitled to any payment of interest for any reason, action or inaction by the Architect or the Owner unless required by law.

§ 13.5.2 Payments withheld for time delays, faulty materials, workmanship, or other failure to follow the Contract Documents shall not bear interest.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract in the manner provided in Subparagraph 14.1.2 only if the Project has been delayed in aggregate more than 100% of the total number of days scheduled for completion as a result of any combination of the following:

.1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;

.2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;

.3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner, without cause, has not made payment on a Certificate for Payment within the time stated in the Contract Documents.

§ 14.1.2 If the requirements of Section 14.1.1 are met, the Contractor may, upon fourteen (14) days written notice to the Owner and Architect, terminate the Contract and recover from the Owner payment on the same basis as if Owner had terminated the Contract for convenience.

§ 14.1.3 If the Work is stopped for a period of 120 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.2.

§ 14.1.4 INTENTIONALLY OMITTED

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

.1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials and/or equipment;

.2 repeatedly fails to make prompt payment to Subcontractors or suppliers as required by the Contract Documents;

.3 disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority;

.4 is otherwise is guilty of substantial breach of a provision of the Contract Documents or disregards significant instructions of Architect or Owner (when such instructions are based on the requirements of the Contract Documents);

.5 is adjudged bankrupt or insolvent, or makes a general assignment for the benefit of Contractor's creditors, or a trustee or a receiver is appointed for Contractor or for any of its property, or files a petition to take advantage of any debtor's act, or to recognize under bankruptcy or similar laws;

.6 breaches any warranty made by the Contractor under or pursuant to the Contact Documents;

.7 fails to furnish the Owner with assurances satisfactory to the Owner evidencing the Contractor's ability to complete the Work in compliance with the requirements of the Contract Documents;

.8 fails after the commencement of the Work to proceed continuously with the construction and completion of the work for more than 10 days except as permitted under the Contract Documents;

.9 repeatedly fails to maintain site cleanliness or site safety;

.10 engages in any acts or omissions specifically identified as providing a basis for termination elsewhere in the Contract Documents; or

.11 repeatedly fails to meet any other obligation of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor. The provision of notice hereunder does not provide the Contractor an opportunity to cure. If Owner terminates under this Section, it may, subject to any prior rights of the surety:

.1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor; and

.2 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the costs of finishing the Work, including compensation for the services of any consultants and the Architect and Construction Manager's services and expenses made necessary thereby, and the other costs and expenses identified hereinafter, exceed the unpaid balance of the Contract Sum, the contractor and its Surety shall pay the difference to the Owner upon demand. The costs of finishing the Work include, without limitation, all reasonable attorney's fees, additional title costs, insurance, additional interest because of any delay in completing the Work, the payment of replacement contractors, and all other direct and indirect consequential costs, including, without limitation, Liquidated Damages for untimely completion as specified in the Contract Documents, incurred by the Owner by reason of, or arising from, or relating to the termination of the Contractor as stated herein.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 INTENTIONALLY OMITTED

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

.1 cease operations as directed by the Owner in the notice;

.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and

.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 Payment for the Owner's termination for convenience shall be as set forth in the Agreement. The warranty and indemnity obligations of the Contractor and Surety shall survive and continue, notwithstanding any termination pursuant to this paragraph, with respect to the Work performed as of the date of termination.

§ 14.4.4 If Owner terminates the Contract for cause pursuant to Section 14.2 and it is subsequently determined that the Owner was not authorized or permitted to terminate the Contract as provided in Section 14.2, the Owner's termination shall be treated as a termination for convenience under this Section 14.4 and the rights and obligations of the parties shall be the same as if the Owner had issued a notice of termination to the Contractor under Section 14.4 rather than Section 14.2.

§ 14.5 In the event of the appointment of a trustee and/or receiver or any similar occurrence affecting the management of the account of the Contractor pertaining to the Work, it shall be the obligation of the Contractor, its representatives, receivers, sureties, or successors in interest to continue the progress of the Work without delay and specifically to make timely payment to Subcontractors and Suppliers of all amounts that are lawfully due them and to provide the Owner and all Subcontractors and Suppliers whose work may be affected with timely notice of the status of receivership, bankruptcy, etc., and the status of their individual accounts.

§ 14.6 Regularly scheduled job meetings shall be held at a location and time convenient to the Owner's representatives, the Architect and the Contractor. The Contractor shall attend such meetings or be represented by a person in authority who can speak for and make decisions for the Contractor.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of and within the period specified by applicable law. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.2.1 No act or omission by the Owner, Construction Manager or Architect, or by anyone acting on behalf of either shall be deemed or construed as a waiver or limitation of any right or remedy under the Contract Documents, or as an admission, acceptance, or approval with respect to any breach of the Contract or failure to comply with the Contract Documents by the Contractor, unless the Owner expressly agrees, in writing.

§ 15.1.2.2 The Owner's exercise, or failure to exercise, any rights, claims or remedies it may have arising out of or relating to the Contract documents shall not release, prejudice, or discharge the Owner's other rights and remedies, nor shall it give rise to any right, claim, remedy or defense by any other person, including the Contractor, its Surety, any Subcontractor, or any other person or entity.

15.1.2.3 Whenever possible, each provision of the Contract Documents shall be interpreted in a manner as to be

effective and valid under applicable law. If, however, any provision of the Contract Documents, or portion thereof, is prohibited or found invalid by law, only such invalid provision or portion thereof shall be ineffective, and shall not invalidate or affect the remaining provision of the Contract Documents or valid portions of such provision, which shall be deemed severable. Further, if any provision of this Contract is deemed inconsistent with applicable law, applicable law shall control, and the provision shall be interpreted to the greatest extent possible in favor of the Owner.

§ 15.1.2.4 Contractor shall promptly pay to Owner all costs and reasonable attorney's fees incurred in connection with any action or proceeding in which Owner prevails, based on a breach of the Contract or other dispute arising out of or in connection with the Contract or Contractor's work on the project.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Injury or Damage to Person or Property. If either party to the Contract suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, written notice of such injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding five (5) days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 15.1.3.3 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim including through litigation, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the resolution of the claim.

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided herein shall be given to the Owner, Construction Manager and Architect before proceeding to execute the portion of the Work that is the subject of the Claim and within five (5) days after the occurrence of the event giving rise to such Claim for increase in the Construct Sum. The foregoing written notice shall contain a written statement from the Contractor setting forth in detail the nature and cause of the Claim and an itemized statement of the increase requested. No such written notice shall form the basis of an increase to the Contract Sum unless and until such increase has been authorized by a written Change Order executed and issued according to the terms and conditions set forth herein. The Contractor hereby acknowledges that the Contractor shall not have any right to and the Owner will not consider any requests for an increase in the Contract Sum that is not submitted in compliance with the foregoing requirements. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 8.3.2 shall be given. Said notice shall itemize all claims and shall contain sufficient detail and substantiating data to permit evaluation of same by Owner, Architect and Construction Manager. No such claim shall be valid unless so made. The Contractor's Claim shall include an estimate of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.6.2 INTENTIONALLY OMITTED

§ 15.1.7 Waiver of Claims for Consequential Damages

The Contractor waive Claims against Owner for consequential damages arising out of or relating to this Contract. This waiver includes, but is not limited to, damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This waiver is applicable, without limitation, to all consequential damages due to Owner's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to litigation. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may file litigation unless mediation is specifically required by the Contract Documents. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

SECTION 01010 - SUMMARY OF WORK

PART 1 - GENERAL

A. The Project consists of an Addition and Renovations to Salem County Career and Technical High School, Woodstown, New Jersey 08098.

B. Owner: The Board of Education for SSSD and VTSD of the County of Salem, Woodstown, New Jersey 08098.

C. Contract Documents were prepared for the Project by Garrison Architects, 713 Creek Road, Bellmawr, NJ 08031; ARH Associates, 215 Bellevue Avenue, Hammonton, NJ 08036; Mulhern Consulting Engineers, 321 South York Road, Hatboro, PA 19040; and Orndorf and Associates, 8600 West Chester Pike Suite 201, Upper Darby, PA 19082.

D. The Work includes but is not limited to the following: (see the Contract Documents for specific work requirements and details):

1. GENERAL NOTES

a) The Bidding Contractors are strongly encouraged to visit the site to verify all existing conditions, dimensions and areas prior to submitting a responsive / responsible bid. Such site visits shall be for familiarizing the Contractor with the conditions as they exist and the character of the operations to be carried on under the Contract Documents, including all existing site conditions, access to the site, physical characteristics of the site and surrounding areas. Site visits can be arranged through **Randy Wentzell, Office Number (856) 769-0101 x 5300, cell (609) 458-1294**.
b) The Contractor shall provide a single full-time onsite Superintendent who is present for all work at all times including, but not limited to, subcontractor work. The Superintendent is responsible for maintaining a daily log of all personnel onsite.
c) During the complete duration of the Work, the Contractor must maintain the continued operation and function of all services and systems including, but not limited to, fire alarm, data, network, information technology, security, audio visual, electrical and HVAC. If a disruption to a system occurs, the Contractor must immediately take all actions necessary to restore the system at the earliest possible time. Any required shutdown of any system needs to be coordinated and scheduled with the Owner at times when school is not in session.
d) This work is scheduled to occur during periods of time when weather protection will be required. The Contractor is responsible for all weather-related protection required to ensure that the work will continue uninterrupted until completion.
e) The Contractor is to provide a list to the Construction Manager with the names of all personnel on site, each day, and no later than two hours after the work has commenced or by 9:00 AM every day via email.
f) The Contractor shall locate all subsurface wires, cables, pipes and pipeline in the work area prior to construction. See General Conditions Section 2.3.4 for additional information.
g) Restore all grades, lawns, concrete curbing, sidewalks, asphalt, and pavement to pre-construction condition.

2. The Project consists of an **ADDITION** of the Submerged-Arc Welding Lab, (approximately. 1,500 SF) at the rear of the building directly adjacent to the existing Welding Shop and the **RENOVATION** of the existing HVAC Lab as follows:

A) **ADDITION - New Submerged-Arc Welding Lab**:

a. **Site Work** - The Project Work includes new asphalt paving at the rear of the building where the new addition is located and includes the access road from the building out to Cheyney Road. The Work also includes limited concrete pads and new parking spaces as shown on the Contract Documents.

b. **General Construction Work** – The building addition will be masonry bearing walls with brick veneer and metal wall panels above to match the existing building. The roof structure consists of sloped steel bar joists and metal deck with a modified roof system over rigid insulation with a tie-in to the existing roof, which is currently under warranty. The finished floor of the new addition will match the floor of the existing Welding Shop. Since the existing Welding Shop will be occupied by the District during the school year, a temporary means of egress from the existing Welding Shop to the exterior **MUST** be installed prior to the start of construction of the new addition and **MUST** be coordinated with the District to be done at a time when school is not in session. All other Work (new toilet room, new lighting, etc) in the existing Welding Shop **MUST** be coordinated with the District and be done when school is not in session.

c. **Plumbing Construction Work** – The Project Work includes but not limited to all items required to construct (1) one single occupant toilet room in the existing Welding Shop as indicated on the Construction Documents.

d. **Mechanical Construction Work** – The Project includes but not limited to all the work required to install (1) rooftop unit with ductwork and exhaust fan as indicated on the Construction Documents.

e. **Electrical Construction Work** – The Project work includes new LED Lighting in the new addition and in the existing Welding Shop and adjacent spaces. The work also includes new Electrical Panels, Feeders, Circuits and Connections for new HVAC systems as indicated on the Contract Documents.

B) **RENOVATION - Existing HVAC Lab:**

a. **- General Construction Work** – The Project Work includes but not limited to the removal of the existing VCT flooring and mastic down to the existing concrete substrate and prepping the existing concrete substrate to receive a new epoxy floor coating with new base per the manufacturer's recommendations. All other Work as indicated in the Contract Documents.

b. **Mechanical/Plumbing Construction Work** – The Project work includes various pieces of equipment that is being furnished by the Owner for instructional purposes. This Contractor will be responsible to provide all appurtenances as indicated in the drawings to make the equipment operational. All other HVAC equipment associated with the building systems shall be furnished and installed by this Contractor as indicated on the Contract Documents.

c. **Electrical Construction Work** – The Project work includes but not limited to new LED Lighting in the existing HVAC Lab and adjacent spaces. The work also includes new Electrical Panels, Feeders, Circuits and Connections

for all HVAC systems & Owner furnished equipment as indicated on the Contract Documents.

E. Schedule of work sequence:

1. No work On Site can be started until all permits are received. The existing school must be completely operational during the school year.
2. All construction preparation work, project startup, submittals, schedules, approvals, procurement, coordination and other preparatory tasks must commence immediately upon receipt of the Notice to Proceed or the date of the fully executed Owner/Contractor Contract, whichever comes first. The Awarded Contractor must be fully prepared to deliver and install all materials and equipment on the first day of the scheduled on **Site Construction** period.
3. The on-site **Construction** period, during which work for the installation of the temporary means of egress and the new addition is to be performed, is to start **ASAP** and extend to no later than **August 23, 2024**. The on-site Construction period, during which the Work inside the existing Welding Shop (not including the temporary means of egress) and the interior renovation work at the HVAC Lab shall start on or about June 17, 2024.

F. The Work will be constructed under one lump sum prime contract.

G. Separate Contract: The Owner has awarded separate contracts for construction operations that will be conducted simultaneously with work under this Contract.

H. Cooperate with separate contractors so that work under those contracts may be carried out smoothly, without interfering with or delaying work under this Contract.

I. Future Contracts: The Owner may award separate contracts for work to be performed following Substantial Completion. Completion of that work depends on completion of work under this Contract. The schedule of this work will be coordinated with the Contractor to ensure the smooth, successful completion of the project.

J. Contractor Use of Premises: During construction, the Contractor shall have full use of the premises (except portions of the existing school outside of the work area), including use of the site inside the construction limit fence. The Contractor's use of premises is limited only by the Owner's right to perform work or employ other contractors on portions of the Project. Any time there is a necessity to enter the existing school outside the work area, the contractors shall coordinate with the Owner's on site representative. **No unauthorized entry will be permitted.**

K. Use of the Site: Limit use of premises to areas indicated inside of the construction limit fence. Do not disturb portions of the site beyond the areas indicated. Areas which will be disturbed shall also be fenced in during construction. **All construction traffic shall be stopped during STUDENT ARRIVAL and STUDENT DISMISSAL TIMES to be identified by the Owner during construction and subject to change.** All other times during the school day, the construction traffic will operate with extra precaution to avoid conflict with school operations and public traffic.

1. The Contractor will have full use of areas within a designated "Contract Limits" as coordinated and agreed upon by the Owner, for performance of the work of this contract, including storage and staging.

2. Access to other areas of the building will not be allowed except as required and specifically authorized in advance to complete individual items of work under this contract. Where so authorized, restrict access to the immediate area of work and only for the time it takes to complete the items of work.

    a. When it is necessary to perform work within the occupied portion of the building, the Contractor shall first advise the Construction Manager at least 48 hours prior to the requested time so that security precautions can be made. This applies to all weekends (Saturday and Sunday).
    b. Provide daily cleaning of facilities; restore any damage at completion of the specific item of work to the complete satisfaction of the Owner's Representative.
    c. Remove all ladders, tools scaffolding, equipment and material at the completion of the specific item of work, at the end of each day, and which may interfere with scheduled activities.

3. Allow for Owner occupancy and use by the public. Provide construction fencing and non-combustible safety barriers for students, faculty and the public.
4. Keep driveways and entrances clear. Do not use these areas for parking or material storage. Schedule deliveries to minimize on-site storage of materials and equipment.
5. All oversized deliveries must be scheduled in coordination with the Owner / Construction Manager. Site limitations during school hours restricts maneuvering of oversized (tractor trailer) vehicles.
6. It is the Contractor's responsibility to provide safe, protected egress from all existing exits from the existing building as directed by the Building Official and the Fire Marshal.
7. Contractor's personnel are not permitted to wear on-site any clothing with wording or graphics that may be construed as offensive, profane or obscene; with wording, graphics or advertising for tobacco or alcoholic products, or attire that appears provocative. The Owner, Construction Manager and/or principal of the school will be the sole judge of what is appropriate or inappropriate.
8. Verbal and visual comments to the school staff, students or anyone other than by the Construction Manager will not be tolerated and will be cause for removal from the site.
9. The use of drugs, cannabis, tobacco or alcohol anywhere on the grounds or in the building will not be permitted and will be cause for removal from the site.
10. The use of radios will not be permitted at any time.

L. Provide temporary construction fencing to completely encompass areas that would be disturbed during construction including areas where material will be stored. Provide "NO TRESPASSING" signs on all construction fencing which is required to completely enclose all construction areas and material storage areas. Provide signage at 40 feet on center or closer.

M. Perform weekly mowing, weed whacking, cleaning and maintenance inside all construction staging areas until the fencing is removed.

N. Use of the Existing Building: Maintain building weather tight. Repair damage caused by construction. Protect the building and its occupants during construction.

O. Full Owner Occupancy: The Owner will occupy the site and existing building during construction. Cooperate with the Owner to minimize conflicts and facilitate Owner usage. Do not interfere with the Owner's operations. The Owner will partially occupy portions of the building during the summer for summer programs.

P. Partial Owner Occupancy: The Owner reserves the right to occupy and to place and install equipment in completed areas of the building prior to Substantial Completion. Placing equipment and partial occupancy do not constitute acceptance of the Work.

1. The Architect will prepare a Certificate of Substantial Completion after the Contractor obtains a Certificate of Occupancy from Building Officials for each portion of Work occupied prior to Owner occupancy.
2. Mechanical and Electrical systems shall be operational and required inspections and tests completed prior to partial Owner occupancy. Upon occupancy, the Owner will operate and maintain systems serving occupied portions of the building.
3. The Owner will be responsible for maintenance and custodial service for occupied portions of the building.

Q. Owner-Furnished Products: The Owner will furnish the equipment associated with the HVAC Lab as indicated in the Contract Documents. The Work includes providing support systems to receive Owner's equipment as follows:

1. Reviewing & coordinating shipping status once the equipment is ordered.
2. Receiving, unloading, storing and inspecting the equipment.
3. Coordinating all aspects of the equipment delivery with the trucker.
4. Accepting, safeguarding and secure storage any accessory shipped separately from the main unit.
5. Provide all Receiving and unloading of all material.
6. Provide All Rigging and permits.
7. Inspect all material upon arrival.
8. Coordinating, filing, and processing of any damage claims with the responsible shipping and delivery vendor.
9. Before installation of equipment, verify that the unit has the proper voltage, gas connections and model numbers.
10. Provide secured storage required with protection from weather, vandalism, and any other potentially damaging conditions.
11. Review equipment for compliance with plans and specifications
12. Reviewing and complying with all manufacturer's recommendations
13. Coordinating all aspects of equipment's' installation, including but not limited to: layout, code compliance, roof penetrations, electrical requirements and protection from weather.
14. This Contractor is responsible for all installation of all equipment and accessories furnished by Owner and/or by this Contractor.
15. Furnish and install all specified Ductwork as indicated on plans and specifications.
16. Furnish and install all specified all Gas Piping and Specialties (booster, regulator, etc.) as indicated on plans and specifications.
17. Provide Cleaning of equipment.
18. Provision of all Balancing and Belt/Sheave Changes required for balancing.
19. Provide all specified Commissioning of equipment installed by this Contractor.
20. Provide all other pertinent services required for proper operation of the above specified equipment installed by this contractor.

21. Provide Testing and Balancing (TAB), required for Balancing of the above specified equipment installed by this contractor.
22. This Contractor shall verify locations, sizes and requirements of all services to equipment, in field with the Owner prior to construction.

R. Fees, Permits and Taxes: The Contractor is advised that Building Permits for each separate building are required for this project. The plans have been submitted to the Construction Official. Upon contract award, it shall be the responsibility of the **Contractor** to secure all required permits. It shall be the **Owner's** responsibility to pay for all fees and permit costs if required. It shall be the **Contractor's** responsibility to pay for all fees and permit costs for the jobsite trailer if required.

S. Provide Project Signs as follows: The Contractor shall furnish and install 4' x 8' project identification and other signs where indicated to inform the public and persons seeking entrance to the Project. The sign shall have 4x4 posts and be three (3) colors. Support on framing of preservative treated wood or steel. Do not permit installation of unauthorized signs. Engage an experienced sign painter to apply graphics. The content of sign shall be similar to the cover sheet of the drawings plus School District Personnel and Board Members and all prime subcontractors' names.

T. SAFETY: The Contractor is responsible for providing and enforcing all safety onsite and conform with all OSHA regulations, codes and standards. The Owner, Construction Manager, Clerk of the Works and Architect have no responsibility to provide for the safety or protection of the trades. The Contractor shall submit a site specific Emergency Action Safety Plan and review this with all onsite personnel. The Contractor shall conduct periodic (as needed at least one a month) site safety inspections and issue a report on the conditions. The Contractor shall maintain a first aid kit onsite. For further Contractor responsibilities with respect to safety, refer to article 10 of the General Conditions of the Contract for Construction.

U. The Contractor shall not use any product containing asbestos and all plumbing shall be lead free. The Contractor shall provide a notarized letter to the Owner during the Project Closeout phase stating: "No asbestos containing materials were provided on the project and the plumbing is lead free".

V. **The Contractor is required to have all long lead items in fabrication and provide proof from the manufacturer within (21) days of the award of the contract. The** Owner will pay for stored material in accordance with the General Conditions. Delays caused by the failure of the Contractor to adhere to this requirement will not be cause for a time extension.

1. Supply Chain Shortages: Due to the ongoing supply chain shortages, the Contractor will be required to do the following:

   a. Once a purchase order has been issued or the Contract has been signed, the Contractor shall order ALL materials ASAP.
   b. The materials must be stored in a secured location, out of the weather and within acceptable storage temperatures. The cost of this material handling is to be included in the project cost.

END OF SECTION 01010

Salem County Vocational Technical School

And

Salem County Special Services School District

School Calendar 2023-2024

BOE Approved 1/24/23

SEPTEMBER '23				
M	T	W	T	F
				1*
4	5*	6	7	8
11	12	13	14	15
18	19	20	21	22
25	26	27	28	29

OCTOBER '23				
M	T	W	T	F
2	3	4	5	6
9	10	11	12	13
16	17	18	19	20
23	24	25	26	27
30	31			

NOVEMBER '23				
M	T	W	T	F
		1	2	3
6	7	~~8~~	9	10
13	14	15	16	17
20	21	~~22~~	23	24
27	28	29	30	

DECEMBER '23				
M	T	W	T	F
				1
4	5	6	7	8
11	12	13	14	15
18	19	20	21	~~22~~
25	26	27	28	29

JANUARY '24				
M	T	W	T	F
1	2	3	4	5
8	9	10	11	12
15	16	17	18	19
22	23	24	~~25*~~	~~26*~~
29	30	31		

FEBRUARY '24				
M	T	W	T	F
			1	2
5	6	7	8	9
12	13	14	15	16
19	20	21	22	23
26	27	28	29	

MARCH '24				
M	T	W	T	F
				1
4	5	6	7	8*
11	12	13	14	15
18	19	20	21	22
25	26	27	28	29

APRIL '24				
M	T	W	T	F
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15	16	17	18	19
22	23	24	25	26
29	30			

MAY '24				
M	T	W	T	F
		1	2	3
6	7	8	9	10*
13	14	15	16	17
20	21	22	23	24
27	28	29	30	31

JUNE '24				
M	T	W	T	F
3	4	5	6	7
10	~~11~~	~~12~~	13*	14
17	18	19	20	21
24	25	26	27	28

Sept. 1	Convocation
Sept. 5	Staff In-Service
Sept. 6	School opens for students/staff
Oct. 9	Columbus Day
Nov. 8	1/2 day students & staff
Nov. 9-10	Teachers Convention
Nov. 22	1/2 day students & staff
Nov. 23-24	Thanksgiving Holiday
Dec. 22	1/2 day students & staff
Dec. 25-Jan.1	Winter Break
Jan. 15	Dr. Martin L. King, Jr. Day
Jan. 25	1/2 day students (Staff In-Service)
Jan. 26	1/2 day students (Staff In-Service)
Feb. 16 - 19	President's Day Weekend
Mar. 8	Countywide In-Service
Mar. 28-April 2	Spring Break
May 10	Staff In-Service (Wellness Day)
May 27	Memorial Day
Jun 11	1/2 day students & staff
Jun 12	Last day for students
Jun 13	Staff In-Service

Sept.	18	Feb.	19
Oct.	21	Mar.	18
Nov.	18	Apr.	20
Dec.	16	May	21
Jan.	21	Jun.	8

Total Student Days 180 **Total Staff Days 185**

School Closed for Students and Staff	
School Closed for Students	
Early Dismissal	
Staff In-Service Days	*
Last Day for Students	
Snow Days	

The first snow day will be taken on February 16. Additional snow days will be added to the end of the school year.

Every attempt will be made to finalize the 2024-2025 calendar by April 1, 2024.

SECTION 01040 – COORDINATION

1.1 GENERAL

A. This Section includes requirements for coordinating construction operations including, but not necessarily limited to, the following:

1. Coordination drawings and Specifications with all subcontractors.
2. Administrative and supervisory personnel.
3. Cleaning and protection is the responsibility of the Contractor.

1.2 COORDINATION

A. Coordinate construction to assure efficient and orderly installation of each part of the Work. Coordinate operations that depend on each subcontractor for proper installation, connection, and operation. The Contractor shall be responsible for the following:

1. Schedule operations in the sequence required to obtain the best results where installation of one part depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to assure maximum accessibility for maintenance, service, and repair.
3. Make provisions to accommodate items scheduled for later installation.
4. Coordination with the school for furniture and equipment which shall be relocated to new facilities.

B. Where necessary, prepare memoranda for distribution to each party involved, outlining procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.

1. Prepare similar memoranda for the Owner and his contractors where coordination of their work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required procedures with other activities to avoid conflicts and assure orderly progress. Such activities include, but are not limited to, the following:

1. Preparation of schedules.
2. Delivery and processing of submittals.
3. Progress meetings.
4. Project closeout activities.

D. Conservation: Coordinate construction to assure that operations are carried out with consideration for conservation of energy, water, and materials.

1. Salvage materials and equipment involved in performance of, but not incorporated in, the Work.

E. Coordination Drawings: Prepare coordination drawings for installation of products and materials fabricated by separate entities. Prepare coordination drawings where limited space necessitates maximum utilization of space for efficient installation of different components.

1. Show the relationship of components shown on separate shop drawings.
2. Indicate required installation sequences.
3. Comply with requirements contained in Section "Submittals."

F. Staff Names: **The Contractor shall** Within 7 days of commencement of construction, submit to the Construction Manager a list of the Contractor's staff assignments, including the superintendent and other personnel at each Project Site. Identify individuals and their responsibilities. List their telephone numbers.

1. Post copies in the Project meeting room, the temporary field office, and each temporary telephone.

1.3 PRODUCTS (Not Applicable)

1.4 EXECUTION

A. Inspection of Conditions: Require Installers of major components to inspect substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected.

B. Coordinate temporary enclosures with inspections and tests to minimize the need to uncover completed construction.

C. Clean and protect construction in progress and adjoining materials, during handling and installation. Apply protective covering to assure protection from damage.

D. Clean and maintain completed construction as necessary through the construction period. Adjust and lubricate operable components to assure operability without damaging effects.

E. Limiting Exposures: Supervise construction to assure that no part is subject to harmful, dangerous, or damaging exposure. Such exposures include, but are not limited to, the following:

1. Excessive static or dynamic loading.
2. Excessive internal or external pressures.
3. Excessively high or low temperatures.
4. Water or ice.
5. Solvents and chemicals.
6. Abrasion.
7. Soiling, staining, and corrosion.
8. Combustion.
9. Excessive dust.

END OF SECTION 01040

SECTION 01045 - CUTTING AND PATCHING

1.1 GENERAL

A. Cutting and Patching Proposal: The Contractor shall be responsible for arranging and providing the necessary cutting and patching that is required to furnish and install all work connected with this project. The Contractor shall submit a proposal describing procedures in advance of the time cutting and patching will be performed. Request approval from the Owner / Architect before proceeding. Include the following:

1. Describe extent of cutting and patching. Show how it will be performed and indicate why it cannot be avoided.
2. Describe changes to existing construction. Include changes to structural elements and operating components and changes in the building's appearance and other significant visual elements.
3. List products to be used and firms that will perform Work.
4. Indicate dates when cutting and patching will be performed.
5. Utilities: List utilities that will be disturbed or relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted. Arrange utility work during the Summer for minimum impact to the Schools' normal functions.
6. Where cutting and patching involves adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with the original structure.
7. Approval to proceed does not waive the Architect's right to later require complete removal and replacement of unsatisfactory work.

B. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would change their load-carrying capacity or load-deflection ratio.

1. Obtain approval before cutting and patching the following structural elements:
   a. Foundation construction.
   b. Existing exterior door system
   c. Bearing and retaining walls
   d. Existing roof system

C. Operational Limitations: Do not cut and patch operating elements in a manner that would reduce their capacity to perform as intended. Do not cut and patch operating elements in a manner that would increase maintenance or decrease operational life or safety.

1. Obtain written approval before cutting and patching the following operating elements or safety related systems:
   a. Primary operational systems and equipment.
   b. Fire protection systems.
   c. Electrical wiring systems.
   d. Water and sewer systems.
   e. H.V.A.C. systems.
   f. Cutting and patching work which affects the operation of the school must be performed after 3:00 P.M. or before 7:30 A.M. so as not to interfere with the schools' operations.
   g. Security System.
   h. Computer System.
   i. Telephone and Cable TV System.

D. Visual Requirements: Do not cut and patch exposed construction in a manner that would, in the Architect's opinion, reduce the building's aesthetic qualities. Do not cut and patch in a manner that would result in visual evidence of cutting and patching. Remove and replace construction cut and patched in a visually unsatisfactory manner.

E. Existing Warranties: Replace, patch, and repair material and surfaces cut or damaged in such a manner as not to void warranties.

1.2 PRODUCTS

A. Use materials that visually match adjacent surfaces to the fullest extent possible. Use materials whose performance will equal that of existing materials.

1.3 EXECUTION

A. Examine surfaces to be cut and patched and conditions under which work is to be performed before cutting. If unsafe or unsatisfactory conditions are encountered, take corrective action.

1. Before proceeding, meet with parties involved. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

B. Temporary Support: Provide temporary support of work to be cut.

C. Protection: Protect existing construction to prevent damage. Provide protection from adverse weather conditions for portions that might be exposed during cutting and patching operations.

D. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

E. Avoid cutting pipe, conduit, or ductwork serving the building but scheduled to be removed or relocated until provisions have been made to bypass them.

F. Performance: Employ skilled workmen. Proceed at the earliest feasible time and complete without delay.

1. Cut construction to install other components or perform other construction and subsequent fitting and patching required to restore surfaces to their original condition.

G. Cutting: Cut using methods that will not damage elements retained or adjoining construction. Comply with the original Installer's recommendations.

1. Use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

2. To avoid marring finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
3. Cut through concrete and masonry using a cutting machine, such as a Carborundum saw or a diamond-core drill.
4. Comply with requirements of applicable Division 2 Sections where cutting and patching requires excavating and backfilling.
5. Where services are required to be removed, relocated, or abandoned, by-pass utility services before cutting. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal the remaining pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.

H. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.

1. Inspect and test patched areas to demonstrate integrity of the installation.
2. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
3. Where removing walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform color and appearance. Remove floor and wall coverings and replace with new materials to achieve uniform color and appearance.

    a. Where patching occurs in a smooth painted surface, extend final paint coat over entire surface containing the patch after the area has received primer and second coat.

4. Patch, repair, or rehang ceilings as necessary to provide an even-plane surface of uniform appearance.

I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar items. Clean piping, conduit, and similar features before applying paint or finishing materials. Restore damaged pipe covering to its original condition.

END OF SECTION 01045

SECTION 01050 - FIELD ENGINEERING

1.1 GENERAL

A. This Section specifies requirements for field-engineering services including, but not limited to, the following:

1. Civil-engineering services.
2. Geotechnical: Conduct monitoring, testing and inspection work during construction.
3. Surveying.

B. Submit a certificate certifying location and elevation of improvements.

C. Project Record Documents: Submit a record of Work performed and record survey data.

1.2 PRODUCTS (Not Applicable)

1.3 EXECUTION

A. Verify layout information, in relation to property survey and existing benchmarks, before proceeding to lay out the Work. Locate and protect existing benchmarks and control points. Preserve permanent reference points during construction.

1. Do not change or relocate benchmarks or control points without written approval. Report destroyed reference points or requirements to relocate reference points because of changes in grades.
2. Replace destroyed Project control points. Base replacements on the original survey control points.

B. Establish and maintain a minimum of 2 permanent benchmarks.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

C. Existing Utilities: The existence of underground utilities and construction is not guaranteed. Verify location of underground utilities and other construction before beginning sitework.

1. Prior to construction, verify location and invert elevation at points of connection of sanitary and storm sewers, and water-service piping.

D. Work from lines and levels established by the property survey. Establish benchmarks and markers to set lines and levels at each story of construction and to locate each element. Calculate and measure required dimensions within indicated or recognized tolerances. Do not scale Drawings to determine dimensions.

1. Advise entities engaged in construction activities of marked lines and levels provided for their use.
2. As construction proceeds, check every element for line, level, and plumb.

E. Surveyor's Log: Maintain a surveyor's log of control and other survey work. Make this log available for reference.

1. Record deviations from lines and levels. Advise the Architect when deviations exceed tolerances. On Project Record Drawings, record deviations that are accepted and not corrected.
2. On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

F. Site Improvements: Locate and lay out site improvements, including pavements, stakes for grading, fill and topsoil placement, utility slopes, and invert elevations.

G. Building Lines and Levels: Locate and lay out batter boards for structures, building foundations, column grids and locations, floor levels, and control lines and levels required for mechanical and electrical work.

H. Existing Utilities: Furnish information necessary to adjust, move, or relocate existing structures, utility poles, lines, services, or other appurtenances located in or affected by construction. Coordinate with local authorities having jurisdiction.

END OF SECTION 01050

SECTION 01095 - REFERENCE STANDARDS AND DEFINITIONS

1.1 GENERAL

A. Definitions: Basic Contract definitions are included in the Conditions of the Contract.

B. Indicated refers to graphic representations, notes, or schedules on the Drawings, paragraphs or Schedules in the Specifications, and similar requirements in the Contract Documents. Terms such as shown, noted, scheduled, and specified are used to help the reader locate the reference. Location is not limited.

C. Directed, requested, authorized, selected, approved, required, and permitted mean directed by the Architect, requested by the Architect, and similar phrases.

D. Approved, when used in conjunction with the Architect's action on submittals, applications, and requests, is limited to the Architect's duties and responsibilities as stated in the Conditions of the Contract.

E. Regulations include laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

F. Furnish means supply and deliver to the Project Site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. Install describes operations at the Project Site including unloading, unpacking, assembly, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. Provide means to furnish and install, complete and ready for the intended use.

I. Installer is the Contractor or another entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier, to perform a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform.

1. The term experienced, when used with the term Installer, means having a minimum of 5 previous projects similar in size and scope to this Project, being familiar with the special requirements indicated, and having complied with requirements of the authorities having jurisdiction.

J. Project Site is the space available for performing construction activities, either exclusively or in conjunction, with others performing work as part of the Project. The extent of the Project Site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.

K. Testing Agency is an independent entity engaged by the Owner to perform specific inspections or tests, either at the Project Site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

L. Specifications are organized into Divisions and Sections based on the Construction Specifications Institute's 16-Division format and MASTERFORMAT numbering system.

1. Abbreviated Language: Language used in Specifications is abbreviated. Implied words and meanings shall be interpreted as appropriate. Singular words shall be interpreted as plural and plural words interpreted as singular where applicable as the context of the Contract Documents indicates.
2. Imperative and streamlined language is used. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the Text, subjective language is used for clarity to describe responsibilities that must be fulfilled indirectly by the Contractor, or by others when so noted.

    a. The words "shall be" are implied where a colon (:) is used within a sentence or phrase.

M. Abbreviations and Names: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States.

1. AABC - Associated Air Balance Council; www.aabc.com.
2. AAMA - American Architectural Manufacturers Association; www.aamanet.org.
3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
7. ABMA - American Boiler Manufacturers Association; www.abma.com.
8. ACI - American Concrete Institute; (Formerly: ACI International); www.concrete.org.
9. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
10. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
11. AF&PA - American Forest & Paper Association; www.afandpa.org.
12. AGA - American Gas Association; www.aga.org.
13. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
14. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
15. AI - Asphalt Institute; www.asphaltinstitute.org.
16. AIA - American Institute of Architects (The); www.aia.org.
17. AISC - American Institute of Steel Construction; www.aisc.org.
18. AISI - American Iron and Steel Institute; www.steel.org.
19. AITC - American Institute of Timber Construction; www.aitc-glulam.org.
20. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
21. ANSI - American National Standards Institute; www.ansi.org.
22. AOSA - Association of Official Seed Analysts, Inc.; www.aosaseed.com.
23. APA - APA - The Engineered Wood Association; www.apawood.org.
24. APA - Architectural Precast Association; www.archprecast.org.
25. API - American Petroleum Institute; www.api.org.
26. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
27. ARI - American Refrigeration Institute; (See AHRI).
28. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
29. ASCE - American Society of Civil Engineers; www.asce.org.

30. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
31. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
32. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
33. ASSE - American Society of Safety Engineers (The); www.asse.org.
34. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.
35. ASTM - ASTM International; www.astm.org.
36. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
37. AWEA - American Wind Energy Association; www.awea.org.
38. AWI - Architectural Woodwork Institute; www.awinet.org.
39. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
40. AWPA - American Wood Protection Association; www.awpa.com.
41. AWS - American Welding Society; www.aws.org.
42. AWWA - American Water Works Association; www.awwa.org.
43. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
44. BIA - Brick Industry Association (The); www.gobrick.com.
45. BICSI - BICSI, Inc.; www.bicsi.org.
46. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); www.bifma.org.
47. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
48. BWF - Badminton World Federation; (Formerly: International Badminton Federation); www.bissc.org.
49. CDA - Copper Development Association; www.copper.org.
50. CE - Conformite Europeenne; http://ec.europa.eu/growth/single-market/ce-marking/.
51. CEA - Canadian Electricity Association; www.clectricity.ca.
52. CEA - Consumer Electronics Association; www.ce.org.
53. CFFA - Chemical Fabrics and Film Association, Inc.; www.chemicalfabricsandfilm.com.
54. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsci.org.
55. CGA - Compressed Gas Association; www.cganet.com.
56. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
57. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
58. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
59. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
60. CPA - Composite Panel Association; www.pbmdf.com.
61. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
62. CRRC - Cool Roof Rating Council; www.coolroofs.org.
63. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
64. CSA - CSA Group; www.csagroup.com.
65. CSA - CSA International; www.csa-international.org.
66. CSI - Construction Specifications Institute (The); www.csinet.org.
67. CSSB - Cedar Shake & Shingle Bureau; www.cedarburcau.org.
68. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.cti.org.
69. CWC - Composite Wood Council; (See CPA).
70. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
71. DHI - Door and Hardware Institute; www.dhi.org.
72. ECA - Electronic Components Association; (See ECIA).
73. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).

74. ECIA - Electronic Components Industry Association; www.eciaonline.org.
75. EIA - Electronic Industries Alliance; (See TIA).
76. EIMA - EIFS Industry Members Association; www.eima.com.
77. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
78. ESD - ESD Association; (Electrostatic Discharge Association); www.esda.org.
79. ESTA - Entertainment Services and Technology Association; (See PLASA).
80. ETL - Intertek (See Intertek); www.intertek.com.
81. EVO - Efficiency Valuation Organization; www.evo-world.org.
82. FCI - Fluid Controls Institute; www.fluidcontrolsinstitute.org.
83. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
84. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
85. FM Approvals - FM Approvals LLC; www.fmglobal.com.
86. FM Global - FM Global; (Formerly: FMG - FM Global); www.fmglobal.com.
87. FRSA - Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.; www.floridaroof.com.
88. FSA - Fluid Sealing Association; www.fluidsealing.com.
89. FSC - Forest Stewardship Council U.S.; www.fscus.org.
90. GA - Gypsum Association; www.gypsum.org.
91. GANA - Glass Association of North America; www.glasswebsite.com.
92. GS - Green Seal; www.greenseal.org.
93. HI - Hydraulic Institute; www.pumps.org.
94. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
95. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
96. HPVA - Hardwood Plywood & Veneer Association; www.hpva.org.
97. HPW - H. P. White Laboratory, Inc.; www.hpwhite.com.
98. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
99. IAS - International Accreditation Service; www.iasonline.org.
100. ICBO - International Conference of Building Officials; (See ICC).
101. ICC - International Code Council; www.iccsafe.org.
102. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
103. ICPA - International Cast Polymer Alliance; www.icpa-hq.org.
104. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
105. IEC - International Electrotechnical Commission; www.iec.ch.
106. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
107. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
108. IESNA - Illuminating Engineering Society of North America; (See IES).
109. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
110. IGMA - Insulating Glass Manufacturers Alliance; www.igmaonline.org.
111. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.okstate.edu.
112. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
113. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.
114. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); www.isa.org.
115. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).

116. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); www.isfanow.org.
117. ISO - International Organization for Standardization; www.iso.org.
118. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
119. ITU - International Telecommunication Union; www.itu.int/home.
120. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
121. LMA - Laminating Materials Association; (See CPA).
122. LPI - Lightning Protection Institute; www.lightning.org.
123. MBMA - Metal Building Manufacturers Association; www.mbma.com.
124. MCA - Metal Construction Association; www.metalconstruction.org.
125. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
126. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
127. MHIA - Material Handling Industry of America; www.mhia.org.
128. MIA - Marble Institute of America; www.marble-institute.com.
129. MMPA - Moulding & Millwork Producers Association; www.wmmpa.com.
130. MPI - Master Painters Institute; www.paintinfo.com.
131. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.org.
132. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
133. NACE - NACE International; (National Association of Corrosion Engineers International); www.nace.org.
134. NADCA - National Air Duct Cleaners Association; www.nadca.com.
135. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
136. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
137. NBI - New Buildings Institute; www.newbuildings.org.
138. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
139. NCMA - National Concrete Masonry Association; www.ncma.org.
140. NEBB - National Environmental Balancing Bureau; www.nebb.org.
141. NECA - National Electrical Contractors Association; www.necanet.org.
142. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
143. NEMA - National Electrical Manufacturers Association; www.nema.org.
144. NETA - InterNational Electrical Testing Association; www.netaworld.org.
145. NFHS - National Federation of State High School Associations; www.nfhs.org.
146. NFPA - National Fire Protection Association; www.nfpa.org.
147. NFPA - NFPA International; (See NFPA).
148. NFRC - National Fenestration Rating Council; www.nfrc.org.
149. NHLA - National Hardwood Lumber Association; www.nhla.com.
150. NLGA - National Lumber Grades Authority; www.nlga.org.
151. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
152. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
153. NRCA - National Roofing Contractors Association; www.nrca.net.
154. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
155. NSF - NSF International; www.nsf.org.
156. NSPE - National Society of Professional Engineers; www.nspe.org.
157. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
158. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
159. NWFA - National Wood Flooring Association; www.nwfa.org.
160. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
161. PDI - Plumbing & Drainage Institute; www.pdionline.org.

162. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); www.plasa.org.
163. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
164. RFCI - Resilient Floor Covering Institute; www.rfci.com.
165. RIS - Redwood Inspection Service; www.redwoodinspection.com.
166. SAE - SAE International; www.sae.org.
167. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
168. SDI - Steel Deck Institute; www.sdi.org.
169. SDI - Steel Door Institute; www.steeldoor.org.
170. SEFA - Scientific Equipment and Furniture Association (The); www.sefalabs.com.
171. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
172. SIA - Security Industry Association; www.siaonline.org.
173. SJI - Steel Joist Institute; www.steeljoist.org.
174. SMA - Screen Manufacturers Association; www.smainfo.org.
175. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
176. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
177. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
178. SPIB - Southern Pine Inspection Bureau; www.spib.org.
179. SPRI - Single Ply Roofing Industry; www.spri.org.
180. SRCC - Solar Rating & Certification Corporation; www.solar-rating.org.
181. SSINA - Specialty Steel Industry of North America; www.ssina.com.
182. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
183. STI - Steel Tank Institute; www.steeltank.com.
184. SWI - Steel Window Institute; www.steelwindows.com.
185. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
186. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
187. TCNA - Tile Council of North America, Inc.; www.tileusa.com.
188. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
189. TIA - Telecommunications Industry Association (The); (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
190. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
191. TMS - The Masonry Society; www.masonrysociety.org.
192. TPI - Truss Plate Institute; www.tpinst.org.
193. TPI - Turfgrass Producers International; www.turfgrasssod.org.
194. TRI - Tile Roofing Institute; www.tileroofing.org.
195. UL - Underwriters Laboratories Inc.; www.ul.com.
196. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.
197. USAV - USA Volleyball; www.usavolleyball.org.
198. USGBC - U.S. Green Building Council; www.usgbc.org.
199. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
200. WA - Wallcoverings Association; www.wallcoverings.org.
201. WASTEC - Waste Equipment Technology Association; www.wastec.org.
202. WCLIB - West Coast Lumber Inspection Bureau; www.wclib.org.
203. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
204. WDMA - Window & Door Manufacturers Association; www.wdma.com.
205. WI - Woodwork Institute; www.wicnet.org.

206. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
207. `WWPA - Western Wood Products Association; www.wwpa.org.

N. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.

1. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
2. ICC - International Code Council; www.iccsafe.org.
3. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

O. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.

1. COE - Army Corps of Engineers; www.usace.army.mil.
2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
4. DOD - Department of Defense; www.quicksearch.dla.mil.
5. DOE - Department of Energy; www.energy.gov.
6. EPA - Environmental Protection Agency; www.epa.gov.
7. FAA - Federal Aviation Administration; www.faa.gov.
8. FG - Federal Government Publications; www.gpo.gov/fdsys.
9. GSA - General Services Administration; www.gsa.gov.
10. HUD - Department of Housing and Urban Development; www.hud.gov.
11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; www.eetd.lbl.gov.
12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
13. SD - Department of State; www.state.gov.
14. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
17. USDOJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
18. USP - U.S. Pharmacopeial Convention; www.usp.org.
19. USPS - United States Postal Service; www.usps.com.

P. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.gpo.gov/fdsys.
2. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.quicksearch.dla.mil.
3. DSCC - Defense Supply Center Columbus; (See FS).
4. FED-STD - Federal Standard; (See FS).
5. FS - Federal Specification; Available from DLA Document Services; www.quicksearch.dla.mil.

   a)Available from Defense Standardization Program; www.dsp.dla.mil.
   b)Available from General Services Administration; www.gsa.gov.
   c)Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org.

6. MILSPEC - Military Specification and Standards; (See DOD).
7. USAB - United States Access Board; www.access-board.gov.
8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

Q. Permits, Licenses, and Certificates: For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established in conjunction with compliance with standards and regulations bearing upon performance of the Work.

END OF SECTION 01095

SECTION 01200 - PROJECT MEETINGS

1.1 GENERAL

A. It is the responsibility of the Construction Manager (CM) to set up, run and record the minutes for the meetings.

B. This Section specifies administrative and procedural requirements for project meetings, including, but not limited to, the following:

1. Preconstruction conferences.
2. Preinstallation conferences.
3. Progress meetings.

C. Preconstruction Conference: A preconstruction conference shall be scheduled before starting any construction to review responsibilities and personnel assignments.

1. Attendees: Authorized representatives of the Owner, CM, Architect, and their consultants; the Contractor and his superintendent; major subcontractors; and other concerned parties shall attend.
   a. Participants shall be familiar with the Project and authorized to conclude matters relating to the Work.

2. Agenda: Discuss items that could affect progress, including the following:

   a. Tentative construction schedule.
   b. Critical work sequencing.
   c. Submittal of Shop Drawings, Product Data, and Samples.
   d. Use of the premises.
   e. Product delivery dates.
   f. Job site safety.

D. Preinstallation Conferences: The CM shall conduct a preinstallation conference before the beginning of each phase of work and with each subcontractor prior to that subcontractor's beginning on-site work.

1. Attendees: The Installer, CM, the Contractor, the Subcontractors related to the work, and representatives of manufacturers and fabricators involved in or affected by the installation shall attend.
   a. Review the progress of other operations and preparations for the activity under consideration at each preinstallation conference, including requirements for the following:
      1) Compatibility problems and acceptability of substrates.
      2) Time schedules and deliveries.
      3) Manufacturer's recommendations.
      4) Warranty requirements.
      5) Inspecting and testing requirements.

   b. The CM shall record significant discussions and agreements and disagreements, and the approved schedule. Promptly distribute the record of the meeting to everyone concerned, including the Owner and the Architect.

c. Do not proceed with the installation if the conference cannot be successfully concluded. Initiate actions necessary to resolve problems and reconvene the conference.

E. Progress Meetings: The CM shall conduct progress meetings at the construction site every two weeks. The Contractor will notify the GC, Owner, the Architect and all subcontractors of scheduled dates. Coordinate meeting dates with preparation of the payment request. It is the Owner/CM /Architect's option to require weekly job site coordination meetings at each job site in addition to the bi-weekly progress meeting.

1. Attendees: The Owner, CM, Architect, Contractor, and other entities concerned with current progress or involved in planning, coordination, or future activities shall be represented. Participants shall be authorized to conclude matters relating to the Work.

F. Agenda: Review and correct or approve minutes of the previous meeting. Review items of significance that could affect progress. Include topics for discussion appropriate to Project status.

1. Contractor's Construction Schedule: The Contractor shall review the progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule. Determine how to expedite construction behind schedule; secure commitments from parties involved to do so. Discuss revisions required to insure subsequent activities will be completed within the Contract Time.

2. Review the present and future needs of each entity present, including the following:

a. Time.
b. Sequences.
c. Status of submittals.
d. Deliveries and off-site fabrication problems.
e. Temporary facilities and services.
f. Quality and work standards.
g. Change Orders.
h. Coordinate with school schedule and programs.

3. Reporting: Distribute meeting minutes to each party present and to parties who should have been present. Include a summary of progress since the previous meeting and report.
4. Schedule Updating: Revise the Contractor's Construction Schedule after each meeting where revisions have been made. Issue the revised schedule concurrently with the report of each meeting.

1.2 PRODUCTS (Not Applicable)

1.3 EXECUTION (Not Applicable)

END OF SECTION 01200

SECTION 01210 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

1. A Lump Sum Amount is specified in this Section of the Contract Documents. This amount shall be included as a separate line item in the Schedule of Values for the Project.

1.3 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, the Contractor shall advise the Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

B. At the Architect's request, the Contractor shall provide a Change Order proposal for additional work to be deducted from the allowance. Include recommendations that are relevant to performing the Work. The Change Order Proposal shall include all material and labor with sufficient breakdown for review.

1.4 SUBMITTALS

A. Submit proposals for purchase of products or systems included in the Cash Allowance, in the form specified for Change Order Requests.

B. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.5 COORDINATION

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.6 CASH ALLOWANCES (Overhead and profit are permitted totaling a maximum of 15% per the AIA Contract. Supervision, bond and insurance are not permitted)

A. Cash Allowance shall be used only as directed and approved by the Architect for the Owner's purposes.

B. The Change Order Request format shall be used to request authorization for use of funds from the Cash Allowance. The Contractor's overhead and profit margins are fixed to a maximum of 15% per the AIA Contract. The Contractor is not permitted to charge for additional supervision, bond and insurance as these costs are included in the Base Contract Sum.

C. At Project closeout, the contractor shall provide a full credit for unused amounts remaining in the Cash Allowance to the Owner by Change Order.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

A. Provide a $100,000.00 cash allowance.

END OF SECTION 01210

SECTION 01300 – SUBMITTALS

1.1 GENERAL

A. The Contractor shall use the enclosed Cover Page form for **every copy** of every shop drawings submitted with the exception of full size drawings that have a title block for custom or project specific materials or systems. The Contractor's Cover Page form shall be signed by the Project Manager with an original signature indicating that the information has been reviewed and coordinated.

B. Submittal Procedures: Coordinate submittal and preparation with construction, fabrication, other submittals, and activities that require sequential operations with all Subcontractors . Transmit in advance of construction operations to avoid delay.

1. Coordinate submittals for related operations to avoid delay because of the need to review submittals concurrently for coordination. The Architect reserves the right to withhold action on a submittal requiring coordination until related submittals are received.
2. Processing: Allow 2 weeks for initial review. Allow more time if the Architect must delay processing to permit coordination with other trades or Owner's contractors. Allow 2 weeks for reprocessing.

    a. No extension of Contract Time will be authorized because of failure to transmit submittals sufficiently in advance of the Work to permit processing.
    b. **All Shop Drawings, product data and samples shall be submitted within forty-five (45) days of Notice of Award. No Payments will be approved if the Shop Drawings process is not completed within this time schedule.**
    c. Substitution submittals shall be made no later than 30 days after Notice to Proceed in order to provide time for comparison review. All submittals after 30 days shall be in strict accordance with the basis of design / specified products. No Substitutions will be considered after 30 days.

C. Contractor's Construction Schedule: Prepare a horizontal bar-chart-type, contractor's construction schedule. Provide a separate time bar for each activity and a vertical line to identify the first working day of each week. Use the same breakdown of Work indicated in the "Schedule of Values." Indicate estimated completion in 10 percent increments. As Work progresses, mark each bar to indicate actual completion.

1. Submit within 14 days of the date established for "Commencement of the Work."
2. Prepare the schedule on stable transparency, or other reproducible media, of width to show data for the entire construction period.
3. Secure performance commitments from parties involved. Coordinate each element with other activities; include minor elements involved in the Work. Show each activity in proper sequence. Indicate sequences necessary for completion of related Work.
4. Coordinate with the Schedule of Values, list of subcontracts, Submittal Schedule, payment requests, and other schedules.

5. Indicate completion in advance of Substantial Completion. Indicate Substantial Completion to allow time for the Architect's procedures necessary for certification of Substantial Completion.
6. Phasing: Show how phased completion affects the Work.
7. Work Stages: Indicate important stages for each portion of the Work.
8. Area Separations: Provide a separate time bar to identify each construction area for each portion of the Work. Indicate where each element must be sequenced with other activities.

D. The Contractor shall receive the schedule from each Subcontractor. The Contractor shall coordinate with all Subcontractors and prepare an overall construction schedule in five (5) days to submit to the Owner / Architect for approval.

Submittal Schedule: After developing the Contractor's Construction Schedule, prepare a schedule of submittals.

1. Coordinate with list of subcontracts, Schedule of Values, list of products, and the Contractor's Construction Schedule.
2. Prepare the schedule in chronological order. Provide the following information:

    a. Date for first submittal.
    b. Related details on drawings.
    c. Related Section number in the Specifications.
    d. Submittal category (Shop Drawings, Product Data, or Samples).
    e. Name of the subcontractor.
    f. Description of the Work covered.
    g. Date for the Architect's final approval.

3. Schedule Distribution: Distribute copies of the Contractor's Construction Schedule and the Submittal Schedule to the Architect, Owner, subcontractors, and parties required to comply with submittal dates. Post copies in the field office.

    a. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their Work and are no longer involved in construction activities.
    b. Updating: Revise the schedule after each meeting or activity where revisions have been made. Issue the updated schedule concurrently with the report of each meeting.

E. Daily Construction Reports: The Contractor shall prepare a daily report recording events at the site and submit copies to the Owner, Construction (if applicable) and Architect on a monthly basis or upon request. Include the following information:

1. List of subcontractors at the site.
2. High and low temperatures, general weather conditions.
3. Accidents and unusual events.
4. Stoppages, delays, shortages, and losses.
5. Meter readings and similar recordings.
6. Emergency procedures.

7. Orders and requests of governing authorities.
8. Services connected, disconnected.
9. Equipment or system tests and startups.
10. Substantial Completions authorized.
11. A list of all visitors indicating the nature of their visit, the company they represent and the person with whom they spoke.

F. Color Selection Schedule: The Contractor shall submit a color selection schedule providing a listing of every product that requires color selections and categorized by exterior colors, interior colors and by room. The Contractor is responsible to coordinate meeting times with the Owner and Construction Manager (if applicable) to select colors so as not to affect the overall construction schedule or material procurement. All color samples shall be delivered to the job site trailer. **Do not submit color samples with shop drawings to the Architect.** Provide actual material color samples. **Reproduced paper or web-based email color charts are not acceptable.**

G. Shop Drawings: The Contractor shall submit newly prepared information drawn to scale. Indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information. The Contractor shall email electronic Shop Drawings to shopdrawings@garrisonarch.com Each separate Shop Drawing shall be submitted in a separate email as one PDF file with the "Shop Drawing Cover Page" completely filled out as the first page. The Shop Drawings shall be numbered sequentially. Include the following information:

1. Dimensions.
2. Identification of products and materials included by sheet and detail number.
3. Compliance with standards.
4. Notation of coordination requirements.
5. Notation of dimensions established by field measurement.
6. Sheet Size: At least 8-1/2 by 11 inches **but no larger than 30 by 42 inches**. The Contractor shall then copy if required and forward the reviewed prints to all of the Subcontractors.

    a. Do not use Shop Drawings without an appropriate final stamp indicating action taken.
7. The Contractor shall be responsible to provide the Owner and Construction Manager (if applicable) with a completed printed set of all final Shop Drawings. Promptly provide each shop drawing paper copy as approved. Do not hold or delay the paper copy from the field.

H. Product Data: Collect Product Data into a single submittal for each element of construction. Mark each copy to show applicable choices and options. Where Product Data includes information on several products, mark copies to indicate applicable information.

1. Include the following information:

    a. Manufacturer's printed recommendations.
    b. Compliance with trade association standards.
    c. Compliance with recognized testing agency standards.

d. Application of testing agency labels and seals.
e. Notation of dimensions verified by field measurement.
f. Notation of coordination requirements.

2. Preliminary Submittal: Submit a preliminary single copy of Product Data where selection of options is required.
3. Submittals: Submit a PDF via email to shopdrawings@garrisonarch.com with the completed "Shop Drawing Cover Page" as the first page of the PDF. The Architect will return the PDF via email marked with action taken. Please note that the Contractor shall be required to submit a paper copy of all finalized Shop Drawings to the Owner and Construction Manager (if applicable).

    a. Unless noncompliance with Contract Documents is observed, the submittal serves as the final submittal.

4. Distribution: Furnish copies to installers, subcontractors, suppliers, and others required for performance of construction activities. Show distribution on Cover Page forms. Do not proceed with installation until a copy of Product Data is in the Installer's possession.

    a. Do not use unmarked Product Data for construction.

I. Samples: Submit full-size Samples cured and finished as specified and identical with the material proposed. Mount Samples to facilitate review of qualities. Provide samples to the Owner or Construction Manager's on-site office. **Do not deliver to the Architect.**

1. Include the following:

    a. Specification Section number and reference.
    b. Generic description of the Sample.
    c. Sample source.
    d. Product name or name of the manufacturer.
    e. Compliance with recognized standards.
    f. Availability and delivery time.

2. Submit Samples for review of size, kind, color, pattern, and texture, for a check of these characteristics, and for a comparison of these characteristics between the final submittal and the actual component as delivered and installed. Where variations are inherent in the material, submit at least 3 units that show limits of the variations.

    a. Refer to other Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar characteristics.
    b. Refer to other Sections for Samples to be incorporated in the Work. Samples must be undamaged at time of use. On the Cover Page, indicate special requests regarding disposition of Sample submittals.
    c. Samples not incorporated into the Work, or designated as the Owner's property, are the Contractor's property and shall be removed from the site.

3. Submittals: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation, and similar characteristics, submit 3 sets. One set will be returned marked with the action taken. Maintain sets of Samples, at the Project Site, for quality comparison.

    a. Unless noncompliance with Contract Documents is observed, the submittal may serve as the final submittal.
    b. Sample sets may be used to obtain final acceptance of the construction associated with each set.

4. Distribution of Samples: Distribute additional sets to subcontractors, manufacturers, and others as required for performance of the Work. Show distribution on Cover Page forms.

J. Quality Assurance Submittals: Submit quality-control submittals, including design data, certifications, manufacturer's instructions, and manufacturer's field reports required under other Sections of the Specifications.

1. Certifications: Where certification that a product or installation complies with specified requirements is required, submit a notarized certification from the manufacturer certifying compliance.
    a. Signature: Certification shall be signed by an officer authorized to sign documents on behalf of the company.

K. Architect's Action: Except for submittals for the record or information, where action and return are required, the Architect will review each submittal, mark to indicate action taken, and return. Compliance with specified characteristics is the Contractor's responsibility.

1. Action Stamp: The Architect will stamp each submittal with an action stamp. The Architect will mark the stamp appropriately to indicate the action taken.
2. Unless requested and paid by the submission contractor, all submittals will be returned by email. All review times start when the Architect receives the submission in his office.
3. Corrections or comments made on the shop drawings during this review do not relieve the contractor from compliance with requirements of the drawings and specifications. This check is only for the review of general conformance with the design concept of the project and general compliance with the information given in the contract documents. The contractor is responsible for verifying quantities, dimensions, field conditions and coordinating all work, information that pertains solely to the fabrication processes or to the means, methods, techniques, sequences and procedures of construction; coordination of the work of all trades; and for performing work in a safe and satisfactory manner. Review does not authorize changes to contracts sum, or project completion date unless stated on separate letter or change order. Refer to the A201 Contract, including but not limited to sections 3.2, 3.3, 3.5, 3.12 and 4.2.7.

M. **The Contractor shall be responsible to note in the Cover Page of the shop drawings any changes or deviations from the contract documents. This is to include but is not limited to manufacturers, electrical, plumbing, mechanical and structural requirements. The Contractor shall be responsible to distribute to all effected contractors and subcontractors all shop drawings which may affect their work.**

N. Deviations from the construction documents must be noted by the General Contractor at the time of shop drawing submission. Failure to do so will result in the implication of Section 3.2 of the General Conditions and Paragraphs 3.2.1, 3.2.2 and 3.2.2.1.

O. Approval of shop drawings is conditional upon the Contractor fully and completely complying with all review comments by the Owner, Architect, and Engineer. Where the Contractor fails to or is unable to fully and completely comply with every review comment, then the shop drawings are *disapproved* (whether or not they are stamped or noted as "approved" in any manner in any review comment) and must be resubmitted as within seven (7) days. Immediately upon receipt of shop drawing review comments, the contractor is responsible for carefully reviewing all comments in detail and for complying with comments. Where unable to fully satisfy any comment or where the contractor takes exception to any comment, revise and resubmit acceptable shop drawings (or, where taking exception, notify the Architect / Engineer in writing) within seven (7) days. Where the Contractor fails to comply with these requirements (including resubmitting/notifying within the seven (7) day period specified), the Contractor shall provide acceptable equipment meeting all specified requirements and all review comments (including removing unacceptable equipment [if installed] and replacing with acceptable equipment) at no cost to the Owner.

P. No extra claims, time or compensation will be granted under any circumstance associated with any party's failure or delay in properly submitting, transmitting, obtaining, reviewing, and/or coordinating shop drawings.

2.1 SUBSTITUTIONS

A. Substitution submittals shall be made **no later than 30 days after Notice to Proceed** in order to provide time for comparison review. All submittals after 30 days shall be in strict accordance with the basis of design / specified products.

B. Materials and equipment manufacturers and catalog numbers specified constitute the type and quality of design, material, workmanship, ruggedness of construction, resistance to vandalism, exact operating and performance characteristics, features, configuration, dimensions, etc. The Architect / Engineer will consider substitutions of brand name or equal equipment equal or superior to specified equipment (meeting or exceeding all characteristics of the specified equipment).

C. Submit shop drawings associated with substitutions complete with **comparison documentation** necessary to establish compliance with the basis of design. Submit samples of substitutions where requested. If comparison documentation and/or samples are not submitted when required, the request for substitution will be denied.

D. Determination of compliance with specifications rests with the Architect/ Engineer. When a request for substitution is denied, furnish the equipment specified. The Architect's / Engineer's decisions in cases of substitutions are final and binding upon the Contractor, provide equipment accordingly

E. Pay all costs associated with a substitution where granted. For the provisions of this section, "substitutions" includes equipment where characteristics or operation vary significantly from equipment specified (including equipment of the specified manufacturer). This includes costs incurred by any party (Contractor, Subcontractors, Owner, Architect, Engineers, etc.), costs resulting from differences of details, configuration, ratings, operation, characteristics, and dimensions between the specified and substituted equipment, costs to provide features of the specified equipment which may be manufacturer's options of the substituted equipment, and costs to remove and replace work already installed and any other remedial work as a result of substitutions. Approval of substitutions is conditional upon there being no cost change to the contract, unless specifically indicated on the shop drawings submittal and corresponding approval. The Contractor is fully responsible for coordinating with the Owner, Architect, and other trades to identify all possible cost impacts associated with any substitution before releasing equipment and before any party proceeds with work effected by the substitution.

F. Submit bid based on the items as specified. Substitutions will be considered only after a contract has been awarded.

G. "Or Equal" substitutions are permitted so long as they are equal to or superior to the basis of design and the Contractor takes full responsibility for all coordination and costs associated with collateral issues related to the substitution. No Substitutions will be reviewed during the bidding process. The Contractor takes full responsibility for all substitutions.

END OF SECTION 01300

Contractor's Letterhead
Contractor's Letterhead to Include Name, Physical Address, Telephone Number and Fax Number
SHOP DRAWING COVER PAGE

Project Name
Date

Garrison Architects
Architect's Name
713 Creek Road
Bellmawr, NJ 08031

Sub Contractor's Name, Physical Address, Telephone Number and Fax Number
Supplier's Name, Physical Address, Telephone Number and Fax Number
Manufacturer's Name, Physical Address, Telephone Number and Fax Number
Specification Number and Specification Title and Section
Construction Document Plan Drawing Number and Detail Reference
Contractor's Quality Assurance Signature

Check one of the following:

☐ The signature above certifies that the enclosed submittal is in conformance with the construction documents and in fact is the **exact** product and manufacturer specified in the bid specifications. The signature confirms that the Contractor is responsible for dimensions and quantities that have been field verified and that the Shop Drawing will be distributed to all affected Contractors whose work may be affected by the material or equipment enclosed.

☐ The signature above certifies that the enclosed submittal is in conformance with the construction documents and in fact a **substitution** of the product and manufacturer specified. The Contractor shall provide all Substitutions no later than thirty (30) days from Notice to Proceed and fully comply with page 01300, paragraph 2.1. A complete comparison document must be provided. The signature confirms that the Contractor is responsible for dimensions and quantities that have been field verified and that the Shop Drawing will be distributed to all affected Contractors whose work may be affected by the material or equipment enclosed.

The Contractor assumes responsibility to fully comply with Specification Section 01300, Submittals," and note below any changes or deviations that have resulted from the proposed product substitution. The Contractor also is solely responsible to communicate these changes to all other Prime Contractor and Sub Contractors following review by the Architect / Engineer.

SHOP DRAWING NO Date Reviewed By

RECEIVED FROM GC		Reviewed	
SENT TO ENGINEER		Provide as Corrected	
RETURN FROM ENG		Revise and Resubmit	
RETURN TO GC		Rejected	

Corrections or comments made on the shop drawings during this review do not relieve contractor from compliance with requirements of the drawings and specifications. The contractor is responsible for all corrections indicated. This check is only for the review of general conformance with the design concept of the project and general compliance with the information given in the contract documents. The contractor is responsible for verifying quantities, dimensions, field conditions and coordinating all work; including all electric for all HVAC and all other equipment; information that pertains solely to the fabrication processes or to the means, methods, techniques, sequences and procedures of construction; coordination of the work of all trades; and for performing work in a safe and satisfactory manner. Review does not authorize changes to contracts sum, or project completion date. Refer to the A201 contract, including but not limited to sections 3.2, 3.3, 3.5, 3.12, and 4.2.7. The contractor shall provide all portions of the work per the manufacture's installation recommendations and instructions.

REQUEST FOR SUBSTITUTION:

Submit this form for each requested substitution. Fill in all blanks, check all boxes that apply and attach all necessary supporting data.

SUBSTITUTION NO.: _____

Specified Item: _____

Specification Section(s)/Paragraph(s): _____

Drawing Number(s): _____

Proposed Substitute: _____
(Include, as applicable, manufacturer's name and address, trade name and model number of product, and name of fabricator or supplier.)

Reason for Proposed Substitution: _____

_____

_____

Net Change to Contract Sum: _____ ☐ No Change; ☐ Deduct $ ____

Change to Contract Time: _____ ☐ No Change;

The following required supporting documents are attached (Check all that apply) Items with a * are mandatory requirements for consideration.:

☐ *Complete Product Data

☐ *Itemized comparison of properties of proposed product to specified product.

☐ *List of other projects on which proposed has been used, with project name, design professional's name and phone number, as well as owner contact name and phone number.

☐ List of maintenance services and replacement materials available.

☐ *Statement of effect of substitution on construction schedule.

☐ *Description of change that will be required in other work or products if substitute product is approved.

ADDITIONAL INFORMATION:

_____

_____

_____

_____

REQUEST FOR SUBSTITUTION:

The undersigned testifies that he/she:

- Is submitting this substitution request within the limits set forth in the Contract Documents.
- Has investigated the proposed product and determined that it is equal or better than the specified product.
- Will provide the same warranty for the proposed product as for the specified product.
- Will coordinate installation and make other changes as required for the work to be complete in all respects, including: (a) redesign and (b) additional components and capacity required by other work affected by the change.
- Waives all claims for additional costs for evaluation of the substitution request, redesign if required, and reapproval by authorities having jurisdiction, if required.
- Will reimburse the Owner for additional costs for evaluation of the substitution request, redesign if required, and reapproval by authorities having jurisdiction, if required.

Contractor's Signature: _____

Typed or Printed Name: _____

Title: _____

Company: _____

Address: _____

Phone Number: _____

Owner Approval: _____ Date: _____

Construction Manager Approval (If Applicable): _____ Date: _____

Garrison Architects Approval: _____ Date: _____

Consulting Engineer Approval: _____ Date: _____

SECTION 01310 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Preliminary Construction Schedule.
2. Contractor's Construction Schedule.
3. Submittals Schedule.
4. Daily construction reports.
5. Material location reports.
6. Field condition reports.
7. Special reports.

1.3 SUBMITTALS

A. Submittals Schedule: Submit six copies of schedule. Arrange the following information in a tabular format:

1. Scheduled date for first submittal.
2. Specification Section number and title.
3. Submittal category (action or informational).
4. Name of subcontractor.
5. Description of the Work covered.
6. Scheduled date for Architect's and Construction Manager's final release or approval.

B. Contractor's Construction Schedule:

1. The Contractor shall prepare, revise and maintain the construction schedule for all subcontractors. The Project will be scheduled and monitored using the latest version of Primavera P6, a proprietary computer software program developed by Primavera Systems, Inc., Bala Cynwyd, PA 19004 or approved equal. The Contractor shall develop the schedule (in coordination with Construction Manager and other Prime Subcontractors) in sufficient detail and clarity so that the contractors can plan, schedule and control the work properly and so that Construction Manager can readily monitor and follow the progress for all portions of the work. Construction Manager shall receive electronic copies of all schedules and updates. The Contractor shall complete a detailed schedule for the entire project that must be submitted and accepted prior to release of the second application for payment. The schedule in no way takes the place of Contractor field coordination.

2. This section describes the Progress Schedule requirements. Each Subcontractor shall provide all necessary information, in connection with their work, in a timely manner, to enable the Contractor to comply with these requirements. The Owner will also have specific needs for phasing of site/construction access and other issues as outlined in the Contract Documents which are to be coordinated within the schedule. No additional costs will be considered to coordinate the phasing needs and reasonable sequencing needs of the Owner. Mandatory scheduling meetings will be held monthly after the Contractor completes the detailed schedule and it is approved by the Construction Manager.
3. The Contractor shall prepare all schedules and all monthly updates based upon information furnished by the Subcontractors and based on Construction Manager's observations of the work in progress. The schedule shall be based upon each of the Subcontractors working schedule and used to plan, and organize the work (in conjunction with the Contractor's field coordination efforts), record and report actual performance and progress, and show how the Subcontractor(s) plans to complete all remaining work.
4. The completed detailed schedule shall be distributed to all Subcontractors and to Construction Manager. When the schedule is approved by the Subcontractor(s) and accepted by the Owner, it shall become one of the Contract Documents. The schedule may be revised to show changes in the Contractor's method or manner of performance; delays, changes, additions or deletions of the work, only after submission to the Construction Manager or Owner and subsequent Construction Manager or Owner's acceptance.
5. This Contract acknowledges that float belongs to the project and can be shared by the Owner and the Contractor(s).

C. Daily Construction Reports: Submit three copies at weekly intervals.

D. Material Location Reports: Submit three copies at weekly intervals.

E. Field Condition Reports: Submit three copies at time of discovery of differing conditions.

F. Special Reports: Submit three copies at time of unusual event.

1.4 QUALITY ASSURANCE

A. Pre-scheduling Conference: Conduct a conference at the Project site. Review methods and procedures related to the Contractor's Construction Schedule, including, but not limited to, the following:

1. Review software limitations and content and format for reports.
2. Verify availability of qualified personnel needed to develop and update schedule.
3. Discuss constraints, including phasing, work stages, area separations, interim milestones, and partial Owner occupancy.
4. Review delivery dates for Owner-furnished products.
5. Review schedule for work of Owner's separate contracts.
6. Review time required for review of submittals and resubmittals.
7. Review requirements for tests and inspections by independent testing and inspecting agencies.
8. Review time required for completion and startup procedures.
9. Review and finalize list of construction activities to be included in schedule.
10. Review submittal requirements and procedures.
11. Review procedures for updating schedule.

1.5 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from parties involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 SUBMITTALS SCHEDULE

A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.

1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.
2. Initial Submittal: Submit prior to initial application for payment. Submit concurrently with preliminary bar-chart schedule or network diagram. Include all submittals in the schedule. List those required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's Construction Schedule.
4. Shop drawing log and schedule is to be updated and submitted at each job meeting along with job meeting report form.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Procedures: Comply with procedures contained in AGC's "Construction Planning & Scheduling."

B. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Final Completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

C. Activities: Treat each story or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
3. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
4. Startup and Testing Time: Include not less than 30 days for startup and testing.
5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's and Construction Manager's administrative procedures necessary for certification of Substantial Completion.

D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Phasing: Arrange list of activities on schedule by phase.
2. Work under More Than One Contract: Include a separate activity for each contract.
3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
4. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Division 01 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
5. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Division 01 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
6. Work Restrictions: Show the effect of the following items on the schedule:

    a. Coordination with existing construction.
    b. Limitations of continued occupancies.
    c. Uninterruptible services.
    d. Partial occupancy before Substantial Completion.
    e. Use of premises restrictions.
    f. Provisions for future construction.
    g. Seasonal variations.
    h. Environmental control.

7. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

    a. Subcontract awards.
    b. Submittals.
    c. Purchases.
    d. Mockups.
    e. Fabrication.
    f. Sample testing.
    g. Deliveries.
    h. Installation.
    i. Tests and inspections.
    j. Adjusting.

k. Curing.
l. Startup and placement into final use and operation.

8. Area Separations: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:

a. Structural completion.
b. Permanent space enclosure.
c. Completion of mechanical installation.
d. Completion of electrical installation.
e. Substantial Completion.

9. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion.

E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using fragments to demonstrate the effect of the proposed change on the overall project schedule.

2.3 CONTRACTOR'S DETAILED CONSTRUCTION SCHEDULE

A. 1. The Contractor with their scheduling consultant will meet with all Subcontractors and the Construction Manager within 7 days after the pre-construction meeting for the purpose of identifying all the scheduling input required for the Contractor to produce the Detailed Schedule. The Detailed Schedule will then be prepared for review within seven (7) calendar days of the meeting. All Subcontractors and Construction Manager shall review the schedule and note any corrections required as a condition of approval within seven (7) calendar days of receipt. The Contractor will prepare a finalized copy of the Detailed Schedule acknowledging their acceptance of the Schedule as their plan to construct the project. The approved, accepted Detailed Schedule will be the Contract Document used by Construction Manager to monitor the progress of the Subcontractor(s). Subsequent meetings may be required with Construction Manager and all Subcontractors. All comments on the schedule will be sent to the Contractor and Construction Manager simultaneously.

The Detailed Schedule shall comply with the various limits imposed by the scope of work and by any contractually specified intermediate milestone dates and completion dates included in the contract. The degree of detail shall be to the satisfaction of Construction Manager.

2. Activity durations will be in work days and will have a maximum duration of twenty (20) WORKING DAYS, except in the case of non-construction activities such as procurement of materials and delivery of equipment. The project calendar shall consider and reflect planned non-work days for weekends, holidays, weather days, and planned premium work such as shift work and extended work days. Milestones will be clearly identified. Intermediate milestones will be required including but not limited to anchor bolt setting, structural steel delivery/erection, sequencing of building areas, building enclosure, overhead rough-in, phased completion of various areas, etc. The Contract Completion date shall be fixed using a constraint.

3. The Contractor will furnish Construction Manager and each Subcontractor with a copy of the initial Detailed logic diagram, computer printouts, detailed bar chart and summary bar chart. Construction Manager will also receive electronic versions of the entire schedule and any updates via email.

4. If the Contractor fails to produce an acceptable Schedule as determined by Construction Manager, Construction Manager may takeover the scheduling requirements and deduct the cost of same from the Contractor's contract sum.

5. In the event a dispute arises regarding the interpretation of the Contract CPM Scheduling requirements; Construction Manager will make the final decision as to interpretation.

6. The activities will be coded to facilitate selection, sorting and preparation of reports. Each activity will have a unique number and description. All construction activities shall be manpower, man-hour and resource loaded. The following activity coding scheme should be used:
   - Responsibility – Identify Contractor, Subcontractor, Owner, etc.
   - Phase – Phase identification from the phasing plan
   - Area – Subdivide schedule activities into logical sections including site, building areas, wings, floors, etc.
   - Masterspec, 16 division format to be assigned.
   - Procurement activities to be separate and include all major submittals, approvals and fab/del times and shall be logically tied to the appropriate installation activity.
   - Coordination and shop drawing logic shall be tied to the submittals.

7. The following computer outputs may be required by Construction Manager as part of the initial schedule submission, and each MONTHLY update thereafter: The Contractor shall provide Construction Manager with a computer disk of the schedule with each submission. All logic changes shall be noted by the consultant in a narrative report that shall also provide an executive summary of the project status.

   - Critical Activity Sort (float equals 10 day or less)
   - Early start sort
   - Eight (8) week "Look Ahead" detailed bar chart with narrative on critical path & milestones.
   - Summary bar chart
   - COM logic diagram (for baseline purposes) and a new logic diagram if logic is revised after baseline is approved.
   - Additional computer sorts as required by Construction Manager
   - Copies shall be provided for each subcontractor
   - One week filter to be used at weekly Foreman's Meeting.

8. The schedule shall show: Activity ID, Activity Description, Original Duration, Remaining Duration, Percent Complete, Early Start, Early Finish, Late Start, Late Finish and Total Float.

B. SCHEDULE UPDATE

1. Each Subcontractor is required to attend and participate in a CPM update review meeting with the Contractor and Construction Manager on a monthly basis. Attendance is mandatory and every effort will be made to have the scheduling meetings immediately following a job meeting. Each Subcontractor will supply update information including a complete and accurate report of procurement items, and work activities. If the information is not submitted, Construction Manager will provide information available at the time of the meeting. The schedule update information will include, but not be limited to:

    a. Actual start dates
    b. Actual completion dates
    c. Activity percent completion with actual start date
    d. Remaining duration of activities in progress

2. All schedule update information outlined above will be reviewed by Construction Manager at the update meeting. The Contractor shall provide Construction Manager with all reports as specified in previous paragraphs within 5 calendar days of the meeting. No logic, original duration, or other changes shall be made to the initial schedule without approval from Construction Manager.

3. The Contractor shall then prepare an eight (8) week look-ahead bar chart that will be issued to all at the next job meeting. A copy of the other scheduling documents will be available to each Subcontractor for review at the jobsite trailer.

4. Issue the draft update by the 25th of the month, final versions to be developed, reviewed and accepted by the contractors by the 5th of the next month.

C. RECOVERY SCHEDULE

1. If the Contractor fails to achieve the planned progress, as indicated in the approved/updated Detailed Schedule and/or the Contractor's lack of progress delays attaining intermediate milestone by more than ten (10) calendar days (monthly or cumulatively); the Contractor will submit to Construction Manager for approval a proposed Recovery Schedule indicating how the Contractor will recover the time lost.

If the Contractor fails to submit a Recovery Schedule and/or fails to cooperate with the Recovery Schedule process, the Construction Manager can immediately order the Contractor to accelerate completion of the late activities by whatever means necessary, including additional personnel, equipment, overtime, double shifts, etc., without any additional costs to the Owner. The Owner/Construction Manager can withhold future progress payments until the Contractor's progress is in compliance with the contract schedule or has approved proposed adjustments to the contract milestones, extension of contract time or modification of the contract schedule.

1. Near the end of the job, Construction Manager may direct the Contractor to establish a detailed work to complete schedule that is updated on a weekly basis.

2.4 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events (refer to special reports).
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Change Directives received and implemented.
16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Partial Completions and occupancies.
19. Substantial Completions authorized.

B. Material Location Reports: At weekly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site.

C. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a request for interpretation. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.5 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Retain Scheduling Consultant: The Contractor shall engage a consultant to provide planning, evaluation, and reporting of the construction schedule if Contractor does not employ skilled personnel with experience in CPM scheduling and reporting techniques. Qualifications of in-house or scheduling consultant shall be submitted for approval within 15 calendar days of the issuance of the Notice to Proceed.

B. Meetings: Scheduler shall attend all meetings related to Project progress, alleged delays, and time impact.

C. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate Actual Completion percentage for each activity.

D. Distribution: Distribute copies of approved schedule to Architect, Construction Manager, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 01310

SECTION 01400 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for quality assurance and quality control. (To be paid and hired by the Owner and coordinated by the Contractor.)

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
2. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

C. See all Contract Documents for specific test and inspection requirements.

1.2 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish the standard by which the Work will be judged.

D. Laboratory Mockups: Full-size, physical assemblies that are constructed at testing facility to verify performance characteristics.

E. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.

F. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.

G. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.

H. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

I. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

J. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.

K. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five (5) previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.3 CONFLICTING REQUIREMENTS

A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.4 SUBMITTALS

A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

B. Reports: Prepare and submit certified written reports that include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.

5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

C. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.5 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirement for specialists shall not supersede building codes and regulations governing the Work.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven (7) days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed, unless otherwise indicated.

J. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in the Contract Documents.

1.6 QUALITY CONTROL

A. Contractor Responsibilities: Quality-control services are the Contractor's responsibility. The Owner will hire and pay for a qualified testing agency to perform these services but it is the Contractor's responsibility to coordinate and remedy any non-conforming work. Additional tests that are required resulting from any non-conforming work shall be paid for by the Contractor.

1. Contractor will furnish the Architect and Owner with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.
3. The Owner will engage a qualified Special Inspector to conduct special tests and inspections oversight in accordance with DCA Bulletin 03-5. The Owner's special inspection services will not relieve the Contractor of responsibility for certifying the work and completing the contract work in accordance with the Contract Documents.

B. The Contractor shall provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required by authorities having jurisdiction, whether specified or not.

1. The Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
3. Submit a certified written report, of each quality-control service to the Construction Manager, Architect, Owner, Special Inspector and authorities having jurisdiction.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."

D. Retesting/Reinspecting: The Contractor shall provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

E. Testing Agency Responsibilities: Cooperate with Architect, Construction Manager, Owner's Special Inspector and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.

7. Security and protection for samples and for testing and inspecting equipment at Project site.

G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.7 SPECIAL TESTS AND INSPECTIONS (BY OWNER)

A. Special Tests and Inspections: Owner will engage a qualified **Testing Agency/Special Inspector** to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner in accordance with DCA Bulletin 03-5, and as follows:

B. Special Tests and Inspections: Conducted by a qualified **Testing Agency/Special Inspector** as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
4. Review test and inspection reports completed by the Contractor's Quality Assurance and Quality Control qualified testing agency. Any irregularities or deficiencies shall be brought to the attention of the Contractor and Architect immediately.
5. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
6. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
7. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.

2. Comply with the Contract Document requirements for Division 01 Section "Cutting and Patching."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

D. The following items shall be tested in accordance with this section if not specifically listed in the Contract Documents as applicable to the Work:

1. Soils and Geotechnical Engineering
2. Foundations
3. Concrete
4. Masonry Reinforcing
5. Structural Steel
6. Cold Formed Steel Framing
7. Roof Trusses (Wood or Steel)
8. Sprayed-on Fire Resistant Materials

END OF SECTION 01400

SECTION 01500 - CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

1.1 GENERAL

A. Summary: This Section specifies construction facilities and temporary controls, including temporary utilities, support facilities, and security and protection facilities.

B. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:

1. Building code requirements.
2. Health and safety regulations.
3. Utility company regulations.
4. Police, fire department. and rescue squad rules. Local traffic requirement.
5. Environmental protection regulations.
6. New Jersey Department of Education.
7. ADA requirements.
8. OSHA.
9. PEOSH Indoor Air Quality Standard.
10. PEOSH Policy on Building Renovation.

The Contractor may be required to pay for and obtain temporary construction trailer permits, temporary electrical permits, etc. as required by the local construction code office.

C. Standards: Comply with NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations," ANSI A10 Series standards for "Safety Requirements for Construction and Demolition," and NECA Electrical Design Library "Temporary Electrical Facilities."

1. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70 "National Electric Code."

D. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

E. Temporary Utilities: Prepare a schedule indicating dates for implementation and termination of each temporary utility. Submit reports and tests, inspections, meter readings, and procedures performed on temporary utilities. At the earliest time, change over from use of temporary service to use of permanent service.

1.2 PRODUCTS

A. Materials: Provide new materials. If acceptable to the Architect, the Contractor may use undamaged, previously used materials in serviceable condition. Provide materials suitable for use intended.

1. Lumber and Plywood: Comply with Division 6 Section "Rough Carpentry." Provide UL-labeled, fire-treated lumber and plywood for temporary offices and sheds. Provide exterior, Grade B-B high density concrete form overlay plywood for signs. Provide 5/8" (16 mm) thick exterior plywood for other uses.

2. Roofing Materials: Provide UL Class A standard-weight asphalt shingles or UL Class C mineral-surfaced roll roofing on roofs of job-built temporary offices, shops, and sheds.
3. Paint: Comply with requirements of Division 9 Section "Painting."

    a. For exposed lumber and plywood, provide exterior-grade acrylic-latex emulsion over exterior primer.
    b. For sign panels and applying graphics, provide exterior-grade alkyd gloss enamel over exterior primer.
    c. For interior walls of temporary offices, provide 2 coats interior latex-flat wall paint.

4. Tarpaulins: Provide waterproof, fire-resistant, UL-labeled tarpaulins with flame-spread rating of 15 or less. For temporary enclosures, provide translucent, nylon-reinforced, laminated polyethylene or polyvinyl chloride, fire-retardant tarpaulins.
5. Water: Provide potable water approved by local health authorities.
6. Open-Mesh Fencing: Provide 0.120-inch- (3-mm-) thick, galvanized 2-inch (50-mm) chainlink fabric fencing 6 feet (2 m) high with galvanized steel pipe posts, 1-1/2 inches (38 mm) I.D. for line posts and 2-1/2 inches (64 mm) I.D. for corner posts.

B. Equipment: Provide new equipment. If acceptable to the Architect, the Contractor may use undamaged, previously used equipment in serviceable condition. Provide equipment suitable for use intended.

1. Water Hoses: Provide 3/4-inch (19-mm), heavy-duty, abrasion-resistant, flexible rubber hoses 100 feet (30 m) long, with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shutoff nozzles at hose discharge.
2. Electrical Outlets: Provide properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-Volt plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button, and pilot light for connection of power tools and equipment.
3. Electrical Power Cords: Grounded extension cords. Use hard-service cords where exposed to abrasion and traffic.
4. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered-glass enclosures where exposed to breakage. Provide exterior fixtures where exposed to moisture.
5. Heating Units: Provide temporary heating units that have been tested and labeled by UL, FM, or another recognized trade association related to the type of fuel being consumed.
6. Fire Extinguishers: Provide hand-carried, portable, UL-rated, Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide hand-carried, portable, UL-rated, Class ABC, dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for the exposures.

    a. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

1.3 EXECUTION

A. Installation, General: Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.

1. **Provide each facility ready for use when needed to avoid delay.** Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.
2. Conditions of Use: Keep temporary facilities clean and neat in appearance. Operate safely and efficiently. Relocated as the Work progress. Do not overload facilities or permit them to interfere with progress. Take necessary fire prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist on-site.
3. **CONTRACTOR SHALL BE PERMITTED TO CONNECT TO THE OWNER'S EXISTING POWER AND WATER SERVICE. OWNER AGREES TO PAY FOR ALL USAGE TO BE BILLED VIA THEIR EXISTING SERVICE. CONTRACTOR IS RESPONSIBLE FOR COORDINATION AND ANY COSTS (OTHER THAN USAGE) ASSOCIATED WITH TEMPORARY MEASURES.**

B. Temporary Utility Installation: The General Contractor shall engage the local utility company to install temporary service or connect to existing service. Where company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with company recommendations.

1. Arrange with company and existing users for a time when service can be interrupted, if necessary, to make connections for temporary services.
2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.
3. Obtain easements to bring temporary utilities to the site where the Owner's easements cannot be used for that purpose.
4. Use Charges: **EXCEPTION: USAGE BILLED VIA THE OWNER'S EXISTING POWER AND WATER SERVICE AS PERMITTED BY PARAGRAPH 3 OF PREVIOUS SECTION 1.3.A.**
5. Temporary Water Service: Install temporary water service and distribution piping of sizes and pressures adequate for construction until permanent water service is in use.
6. Temporary Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnects, automatic ground-fault interrupters, and main distribution switch gear.

    a. Power Distribution System: Install wiring overhead and rise vertically where least exposed to damage.
    b. Temporary Lighting: Provide temporary lighting with local switching to fulfill security requirements and illumination for construction operations and traffic conditions.

c. If temporary power/lighting connect to the Owner's panel, the General Contractor shall compensate the Owner for the electrical usage.
d. Under no circumstances will the temporary electric be turned off due to labor disputes, work hours, etc.

C. Temporary Heat: (installed and paid of usage by the Contractor). Provide temporary heat required by construction activities for curing or drying of completed installations or for protection of installed construction from adverse effects of low temperatures or high humidity. Temporary heat must be on to dry out masonry walls at least two weeks prior to painting. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy. All temporary heat must be on by November 11th. Anywhere in the building, the minimum temperature is to be 60 degrees Fahrenheit.

1. Heating Facilities: **The use of the building's permanent HVAC systems is prohibited and shall not be used. The building must be 100% white glove clean and dust free prior to starting the HVAC system**. Provide vented, self-contained, LP-gas or fuel-oil heaters with individual space thermostatic control. Use of gasoline-burning space heaters, open flame, or salamander heating units is prohibited. Where required, contractor shall be responsible to obtain and pay for temporary heating permits.
2. Safety Requirements: provide a fire extinguisher for each heating unit,. Comply with all local, governmental and manufacturer's requirements for safe operation.

D. Temporary Telephones: The General Contractor shall be responsible for their own telephone service.

E. Sanitary Facilities: (installed and paid for maintenance by General Contractor). Comply with regulations and health codes for the type, number, location, operation, and maintenance of fixtures and facilities. Install where facilities will best serve the Project's needs. Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Provide covered waste containers for used material.

1. Toilets: Install self-contained, single occupant toilet units of the chemical, aerated recirculation, or combustion type. Provide units properly vented and fully enclosed with a glass fiber reinforced polyester steel or similar nonabsorbent material. Shield toilets to ensure privacy. Use of pit-type privies will not be permitted. The construction team are not permitted to use the school facilities at any time. Provide separate facilities for male and female personnel.

F. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel involved in handling materials that require wash-up for a healthy and sanitary condition. Dispose of drainage properly. Supply cleaning compounds appropriate for each condition.

1. Provide safety showers, eyewash fountains, and similar facilities for convenience, safety, and sanitation of personnel.

F. Support Facilities Installation: Locate field offices, storage sheds, and other temporary construction and support facilities for easy access. Maintain facilities until near Substantial Completion. Remove prior to Substantial Completion.

1.. Contractor's Field Office: Provide services and conditions as required to complete construction **WITHOUT THE USE OF THE OWNER'S TELEPHONE, COPY, FAX, ETC. NO EXCEPTIONS.**

2. Construction Manager, Owner's Field Office: **NOT REQUIRED.**

3. Provide incombustible construction for offices, shops, and sheds located within the construction area or within 30 feet (9 m) of building lines. Comply with requirements of NFPA 241.

4. Storage and Fabrication Sheds: (General Contractors): Install storage and fabrication sheds sized, furnished, and equipped to accommodate materials and equipment involved, including temporary utility service. Sheds may be open shelters or fully enclosed spaces within the building or elsewhere on-site.

5. Dewatering Facilities and Drains: (by General Contractor). For temporary drainage and dewatering facilities and operations, comply with dewatering requirements of applicable Division 2 Sections. Where feasible, utilize the same facilities. Maintain the site, excavations, and construction free of water.

6. Temporary Enclosures: (by General Contractor). Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Where heat is needed and the permanent building enclosure is not complete, provide temporary enclosures where there is no other provision for containment of heat. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.

   a. Install tarpaulins securely, with incombustible wood framing and other materials. Close openings of 25 sq. ft. (2.3 sq. m) or less with plywood or similar materials.
   b. Close openings through floor or roof decks and horizontal surfaces with load-bearing, wood-framed construction.

7. Temporary Lifts and Hoists: The General Contractor shall provide facilities for hoisting their own materials.

8. Collection and Disposal of Waste: (General Contractor). The General Contractor shall collect their own waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly.

   a. Do not hold materials more than 7 days during normal weather or 3 days when the temperature is expected to rise above 80 deg F (27 deg C).

G. Security and protection facilities installation: (by General Contractor). Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer, as requested by the Architect.

1. Temporary Fire Protection: (by General Contractor). Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers" and NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations."

    a. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor at or near each usable stairwell.
    b. Store combustible materials in containers in fire-safe locations.
    c. Prohibit smoking in hazardous fire-exposure areas.
    d. Provide supervision of welding operations, combustion-type temporary heating units, and similar sources of fire ignition.

2. Permanent Fire Protection: At the earliest feasible date in each area of the Project, complete installation of the permanent fire-protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.
3. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed, provide lighting, including flashing red or amber lights.
4. Security Enclosure and Lockup: Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.
5. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways, and subsoil might be contaminated or polluted or that other undesirable effects might result. Avoid use of tools and equipment that produce harmful noise. Restrict use of noise-making tools and equipment to hours that will minimize complaints from persons or firms near the site.

H. Operation: The Contractor shall be responsible to enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.

I. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements. Maintain temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

J. Protection: Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

K. Termination and Removal: Unless the Architect requests that it be maintained longer, remove each temporary facility when the need has ended, when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are the Contractor's property. The Owner reserves the right to take possession of project identification signs.
2. At Substantial Completion, clean and renovate permanent facilities used during the construction period including, but not limited to, the following:

    a) Replace air filters and clean inside of ductwork and housings of existing HV/AC equipment.
    b) Replace significantly worn parts and parts subject to unusual operating conditions.
    c) Replace lamps burned out or noticeably dimmed by hours of use.

3. Prior to Final Completion, restore site damages resulting from construction activities. This includes, but is not limited to: removal of temporary fencing; restoring site disturbance resulting from contractor parking, trailers, sanitary facilities, dumpsters, construction equipment, etc. Site restoration to include fine grading with approved topsoil and reseeding with approved seed.

END OF SECTION 01500

SECTION 01524 - CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for the following:

1. Salvaging nonhazardous construction waste.
2. Recycling nonhazardous construction waste.
3. Disposing of nonhazardous construction waste.

1.3 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

C. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

D. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

E. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 PERFORMANCE GOALS

A. General: Develop waste management plan that results in end-of-Project rates for salvage/recycling of 50 percent by weight of total waste generated by the Work.

B. Salvage/Recycle Goals: Owner's goal is to salvage and recycle as much nonhazardous construction waste as possible including the following materials:

1. Construction Waste:

a. Site-clearing waste.
b. Masonry and CMU.
c. Lumber.
d. Wood sheet materials.

e. Wood trim.
f. Metals.
g. Roofing.
h. Insulation.
i. Carpet.
j. Gypsum board.
k. Piping.
l. Electrical conduit.
m. Packaging: Regardless of salvage/recycle goal indicated above, salvage or recycle 100 percent of the following uncontaminated packaging materials:

1) Paper.
2) Cardboard.
3) Boxes.
4) Plastic sheet and film.
5) Polystyrene packaging.
6) Wood crates.
7) Plastic pails.

1.5 SUBMITTALS

A. Waste Management Plan: Submit 3 copies of plan within 30 days of date established for the Notice to Proceed.

B. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Waste Management Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:

1. Review and discuss waste management plan including responsibilities of Waste Management Coordinator.
2. Review requirements for documenting quantities of each type of waste and its disposition.
3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.

1.7 WASTE MANAGEMENT PLAN

A. General: Develop plan consisting of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

B. Waste Identification: Indicate anticipated types and quantities of site-clearing and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.

D. Forms: Prepare waste management plan on forms included at end of Part 3.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement waste management plan as approved by Architect. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

1. Comply with Division 1 Section "Temporary Facilities and Controls" for operation, termination, and removal requirements.

B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.

C. The Contractor shall have a full time laborer onsite to actively clean and control construction waste/debris in and around construction areas.

D. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.

1. Distribute waste management plan to everyone concerned within three days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

E. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
2. Comply with Division 1 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until installation.
4. Protect items from damage during transport and storage.
5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

B. Salvaged Items for Sale and Donation: Not permitted on Project site.

C. Salvaged Items for Owner's Use:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area on-site.
5. Protect items from damage during transport and storage.

D. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.

3.3 RECYCLING CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.

C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical.

1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

3.4 RECYCLING DEMOLITION WASTE

A. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.

1. Pulverize concrete to maximum 4-inch (100-mm) size.

B. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.

1. Clean and stack undamaged, whole masonry units on wood pallets.

C. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

D. Metals: Separate metals by type.

1. Structural Steel: Stack members according to size, type of member, and length.
2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

E. Gypsum Board: Stack large clean pieces on wood pallets and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

F. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.

1. Separate suspension system, trim, and other metals from panels and tile and sort with other metals.

G. Carpet: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.

1. Store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

H. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.

I. Conduit: Reduce conduit to straight lengths and store by type and size.

3.5 RECYCLING CONSTRUCTION WASTE

A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Site-Clearing Wastes: Chip brush, branches, and trees on-site.

C. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

D. Gypsum Board: Stack large clean pieces on wood pallets and store in a dry location.

1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

3.6 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Transport waste materials off Owner's property and legally dispose of them.

END OF SECTION 01524

SECTION 01600 - MATERIALS AND EQUIPMENT

1.1 GENERAL

A. "Products" are items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock.

1. "Named Products" are items identified by the manufacturer's product name, including make or model number or designation, shown or listed in the manufacturer's published product literature.

B. "Materials" are products substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.

C. "Equipment" is a product with operational parts, whether motorized or manually operated, that requires service connections, such as wiring or piping.

D. Product List: Products required are included in all sections of these specifications. Provide the manufacturer's name and proprietary product names for each item. Coordinate product list with the Contractor's Construction Schedule and Submittal Schedule.

1. Form: Prepare product list with information on each item tabulated under the following column headings:

a. Related Specification Section number.
b. Generic name used in Contract Documents.
c. Proprietary name, model number, and similar designations.
d. Manufacturer's name and address.
e. Supplier's name and address.
f. Installer's name and address.
g. Projected delivery date or time span of delivery period.

2. Within 30 days after date of commencement of the Work, submit 3 copies of the product list. Provide a written explanation for omissions of data and variations from Contract requirements.
3. The Architect will respond within 2 weeks of receipt of the list. No response within this period constitutes no objection to listed manufacturers or products but does not waive the requirement that products comply with Contract Documents. The Architect's response will include a list of unacceptable products.

E. Source Limitations: To the fullest extent possible, provide products of the same kind from a single source.

1. When the Contractor is given the option of selecting between 2 or more products for use on the Project, the product selected shall be compatible with products previously selected.

F. Nameplates: Except for required labels and operating data, do not attach manufacturer's nameplates or trademarks on surfaces exposed to view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on concealed surfaces or, where required for observation after installation, on accessible surfaces that are not conspicuous.
2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface that is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:

    a. Name of product and manufacturer.
    b. Model and serial number.
    c. Capacity.
    d. Speed.
    e. Ratings.

G. Deliver, store, and handle products according to the manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft.

1. Schedule delivery as early as possible. Coordinate with installation to assure safety for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
2. Deliver products in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
3. Inspect products upon delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
4. Store products to facilitate inspection and measurement of quantity or counting of units. Store heavy materials away from the structure in a manner that will not endanger the supporting construction.
5. Store products subject to damage by the elements aboveground, under cover in a weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

1.2 PRODUCTS

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, new at the time of installation.

1. Provide products complete with accessories, trim, finish, safety guards, and other devices and details needed for a complete installation and the intended use and effect.
2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.

B. Product Selection Procedures: Procedures governing product selection include the following:

1. Proprietary Specification Requirements: Where products are specified by name, accompanied by the term "or equal" or "or approved equal" comply with specified product standards and data to obtain approval for use of an unnamed product. See Specification Section 01300, "Submittals," page 01300-6 and 01300-7, Paragraph 2.1 for specific Substitution requirements.
2. Nonproprietary Specifications: When Specifications list products or manufacturers that are available and may be incorporated in the Work, but do not restrict the Contractor to use of these products only, the Contractor may propose any available product that complies with Contract requirements. Comply with Contract Document provisions concerning submissions to obtain approval for use of an unnamed product.
3. Descriptive Specification Requirements: Where Specifications describe a product, listing characteristics required, with or without use of a brand name, provide a product that provides the characteristics and otherwise complies with requirements.
4. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply and are recommended for the application. Manufacturer's recommendations may be contained in product literature or by the manufacturer's certification of performance.
5. Compliance with Standards, Codes, and Regulations: Where Specifications only require compliance with an imposed code, standard, or regulation, select a product that complies with the standards, codes, or regulations specified.
6. Visual Matching: Where Specifications require matching a Sample or existing building items, the Architect's decision on whether a product matches will be final.
7. Visual Selection: Where requirements include the phrase "... as selected from manufacturer's standard colors, patterns, textures ..." or a similar phrase, select a product that complies with other requirements. The Architect / Owner will select the color, pattern, and texture from the product line selected.

1.3 EXECUTION

A. Comply with manufacturer's instructions for installation of products. Anchor each product securely in place, accurately located and aligned with other Work. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

END OF SECTION 01600

SECTION 01700 - CONTRACT CLOSEOUT

1.1 GENERAL

A. Please refer to the **"PROJECT CLOSEOUT CHECKLIST"** at the end of this section for the summary of materials required to complete the contract obligation. Closeout requirements for specific construction activities are included in the appropriate Sections in Divisions 2 through 16.

B. Substantial Completion: The Contractor shall request the Owner, Construction Manager (if applicable) and Architect to inspect the job and perform a punch list to certify Substantial Completion. Refer to Specification Section AIA 201 General Conditions of the Contract for Construction, paragraph 9.8, for the definition of Substantial Completion. Before requesting inspection for certification of Substantial Completion, the Contractor shall complete the following:

1. "PUNCH LIST": Before the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list (PUNCH LIST) of items to be completed or corrected. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

2. The Contractor shall perform a Quality Control / Quality Assurance QC/QA Punchlist of all work prior to requesting Substantial Completion and a punch list from the Owners Team. The Contractor's Project Manger shall take the lead and conduct an onsite review with the Contractor's superintendent and representation from every major sub prime contractor. Notification of this onsite walk thru shall be provided in writing to all members of the Owners Team who may or may not choose to attend. The Contractor's Project Manager shall record and distribute this QC/QA Punchlist in a matrix that provides an additional column for the Contractor to document the completion of the work and the date. After successful completion of the Contractor's QC/QA Punchlist and all work, the Contractor shall request the Construction Manager and Architect perform a Punchlist. Substantial Completion shall be requested in accordance with paragraph 9.8.1 of Specification Section AIA 201 General Conditions of the Contract for Construction,

3. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the Work claimed as substantially complete.

    a. Include supporting documentation for completion and an accounting of changes to the Contract Sum.

4. Advise the Owner of pending insurance changeover requirements.
5. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents.
6. Submit record drawings, maintenance manuals, and, if specified elsewhere, final project photographs, damage or settlement surveys, property surveys, and similar final record information.
7. Deliver tools, spare parts, extra stock, and similar items.

8. Changeover locks and transmit keys to the Owner.
9. Changeover temporary construction utilities to Owner including electric, water, gas, sewer, storm, fire protection, etc.
10. Complete startup testing of systems and instruction of operation and maintenance personnel. Remove temporary facilities, mockups, construction tools, and similar elements.
11. Complete final cleanup requirements, including touchup painting.
12. Touch up and repair and restore marred, exposed finishes.
13. Submit Certificate of Occupancy/Approval
12. Remove temporary covered walkway, fence, and complete all curbs, paving, concrete walks, etc.

C. Inspection Procedures: On receipt of a request for inspection, the Construction Manager will proceed or advise the Contractor of unfilled requirements. The Architect will prepare the Certificate of Substantial Completion following inspection or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.

1. The Construction Manager (if applicable) or Architect will repeat inspection when requested and assured that the Work is substantially complete.
2. Results of the completed inspection will form the basis of requirements for final acceptance.

D. Final Acceptance: Please refer to the **"FINAL PAYMENT CHECKLIST"** at the end of this section for the summary of materials required to complete the contract obligation. All **"PROJECT CLOSEOUT CHECKLIST"** items shall be completed before requesting Final Acceptance or Final Payment.

E. Reinspection Procedure: The Construction Manager will reinspect the Work upon receipt of notice that the Work has been completed, except for items whose completion is delayed under circumstances acceptable to the Owner, Construction Manager and Architect.

1. Upon completion of reinspection, the Architect will prepare a certificate of final acceptance. If the Work is incomplete, the Architect will advise the Contractor of Work that is incomplete or obligations that have not been fulfilled but are required.
2. If necessary, one (1) reinspection will be provided free of cost to the Contractor. If the Contractor fails to complete the work and a third or subsequent inspections are required, then the Contractor agrees to to pay the Construction Manager and/or Architect for all extra inspections.

F. Record Document Submittals: Do not use record documents for construction. Protect from loss in a secure location. Provide access to record documents for the Construction Manager's (if applicable) / Architect's reference.

G. Record Drawings: Maintain a set of Original Signed and Sealed Prints of Contract Documents and Shop Drawings in the job trailer accessible to the Local Authority having jurisdiction, Owner, Construction Manager and/or Architect. The drawings shall be updated daily. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark the drawing most capable of showing conditions fully and accurately. Give attention to concealed elements.

1. Mark sets with red pencil. Use other colors to distinguish between variations in separate categories of the Work.
2. Organize record drawing sheets into manageable sets. Bind with durable-paper cover sheets; print titles, dates, and other identification on the cover of each set.

H. Maintenance Manuals: Organize operation and maintenance documents into two (2) sets of manageable size. Bind in individual, heavy-duty, 2-inch (51-mm), 3-ring, binders, with pocket folders for folded sheet information. Mark identification on front and spine of each binder. Include all the information required in the **"PROJECT CLOSEOUT CHECKLIST." Project Closeout Checklist Documents including these Maintenance Manuals shall be delivered to the OWNER OR CONSTRUCTION MANAGER (if applicable).**

I. Record RFIs (Request for Information): The Contractor shall maintain a complete record of all RFIs in the job trailer accessible to the Local Authority having jurisdiction, Owner, Construction Manager and/or Architect. The RFI Logbook shall be updated daily and subject to the penalty of non-payment if it is not up to date.

1.2 PRODUCTS (Not Applicable)

1.3 EXECUTION

A. Operation and Maintenance Instructions: The Contractor shall coordinate and arrange for each Installer/Manufacturer to provide instruction in proper operation and maintenance to the Owner's Staff. Refer to the applicable Specification Section for the requirements of Owner Instruction. The Owner, Construction Manager (if applicable), and Architect shall be notified of this instructional meeting 3 days in advance. The instructional meeting shall include a detailed review, but not be limited to, the following items:

1. Maintenance manuals.
2. Spare parts, tools, and materials.
3. Lubricants and fuels.
4. Identification systems.
5. Control sequences.
6. Hazards.
7. Warranties and bonds.
8. Maintenance agreements and similar continuing commitments.

B. As part of instruction for operating equipment, demonstrate the following:

1. Startup and shutdown.

2. Emergency operations and safety procedures.
3. Noise and vibration adjustments.

C. Final Cleaning: Employ experienced cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Complete the following operations before requesting inspection for certification of Substantial Completion.

1. Remove labels that are not permanent labels.
2. Clean transparent materials, including mirrors and glass. Remove glazing compounds. Replace chipped or broken glass.
3. Clean exposed finishes to a dust-free condition, free of stains, films, and foreign substances. The Contractor shall clean vinyl composite tile, ceramic tile, terrazzo, sealed concrete, etc. "mop clean." Strip all VCT flooring and apply three coats of wax. Vacuum carpeted surfaces.
4. Wipe surfaces of mechanical and electrical equipment to a dust free condition. Remove excess lubrication. Clean plumbing fixtures. Clean light fixtures and lamps.
5. Clean the site of rubbish, litter, and foreign substances. Sweep paved areas; remove stains, spills, and foreign deposits. Rake grounds to a smooth, even-textured surface.

D. Removal of Protection: Remove temporary protection and facilities.

E. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Remove waste materials and dispose of lawfully.

F. Contractor shall provide an as-built survey of all installed utilities, as well as existing utility features to remain that are uncovered during construction, including locations and elevations. The as-built survey shall be provided as a hard copy plan sheet and in electronic format (AutoCAD or similar file type) on a CD, flash drive or similar acceptable electronic media.

END OF SECTION 01700

PROJECT CLOSEOUT CHECKLIST

CONTRACTOR MUST COMPLETE AND SUBMIT (1) ONE SET OF AS-BUILT DOCUMENTS, TWO (2) SETS OF CLOSEOUT BINDERS AND ONE (1) TRAINING VIDEO TO THE OWNER OR CONSTRUCTION MANAGER WITH AN ELECTRONIC COPY OF THE AS-BUILT DOCUMENTS EMAILED TO THE OWNER, CONSTRUCTION MANAGER (if applicable) AND ARCHITECT

Complete,
Incomplete or
N/A_____

AS-BUILT DOCUMENTS - ONE SET per Building Location

* All As-Built Documents must be clearly labeled "AS-BUILT" with a date and Contractor's signature. If the Owner has contracted with a Construction Manager, the Contractor must review all As-Built notations with the C.M. prior to delivering to Owner.

1. Record "as-built" contract drawings. (1 paper copy & PDF files emailed to the Owner, Construction Manager (if applicable) and Architect. In lieu of emailing the file, the Contractor can provide a flash drive of the PDF.)

2. Record "as built" shop drawings. (1 paper copy & PDF files emailed to the Owner, Construction Manager (if applicable) and Architect. In lieu of emailing the file, the Contractor can provide a flash drive of the PDF.)

CLOSE-OUT BINDERS - TWO SETS per Building Location

* All items shall be in a 3-ring loose leaf binder, clearly labeled (minimum: building, discipline/trade & year) on Front and Side Spine. Include a helpful table of contents and index tabs. Also provide this information in a PDF File emailed to the Owner and Construction Manager (if applicable.)

1. Maintenance manuals/operating and maintenance instruction. See Specification Section 01700.

2. Warranties and bond manual. See Specification Section 01740.
   * WARRANTY CLARIFICATION: Contractor shall separately identify any warranty that requires execution by Owner or otherwise. "Copies" of warranties should be included in the close-out "binder". "Original" warranties requiring execution should be sent under a separate cover. The separate cover should clearly identify the action required to execute the warranty.

3. List of contact persons for the Contractor and all sub-contractors. Include contract responsibility, name of company, name of person, street address, mailing address (if different), telephone and email address.

4. Copy of final inspection reports / permit closeout document.

5. Attic Stock, Special tools, spare parts, extra stock materials, etc. shall be turned over to Owner. Include a list in the closeout binder.

OWNER TRAINING VIDEO – ONE COPY per Building Location
FINAL PAYMENT CHECKLIST

Complete, Incomplete or N/A

*** DO NOT submit Final Payment until all items can be included.**

CONTRACTOR MUST COMPLETE AND SUBMIT (3) THREE SETS OF COLLATED, NOTARIZED ORIGINALS & (1) ONE COMPLETE ELECTRONIC COPY VIA EMAIL TO THE ARCHITECT WITH FINAL PAYMENT APPLICATION:

1. An Index of Documents Included on the Contractor's Letterhead.
2. Owner Payment Voucher (if required by Owner).
3. AIA Payment Application.
4. AIA Document G706 – 1994 Contractor's Affidavit of Payment of Debts and Claims
5. AIA Document G706A – 1994 Contractor's Affidavit of Release of Liens
6. Contractor's Certification of Completion
7. AIA Document G707 – 1994 Consent of Surety to Final Payment
8. Maintenance Bond for 100% of the Project Cost for a warranty period of two (2) years from the Date of Final Acceptance.
9. The Contractor shall not use any product containing asbestos and all plumbing shall be lead free. The Contractor shall provide a notarized letter stating: " No asbestos containing materials were provided on the project and the plumbing is lead free."
10. Contractor shall furnish a letter agreeing to provide complete parts and labor service and maintenance of all HVAC systems, equipment, devices, controls, etc., for 2 years from date of substantial completion as determined by architect. The letter shall also affirm that the Contractor will provide scheduled maintenance service quarterly (3-month interval) as the maximum time period between scheduled service.
11. Certificate of Occupancy or Acceptance by the Local Construction Official.
12. Provide a Fire Alarm System NFPA Record of Inspection and Testing Certification Form.

ADDITIONAL REQUIREMENTS TO BE SATISFIED PRIOR TO CERTIFICATION OF FINAL PAYMENT:

1. Project Closeout Documents (submit separately as indicated on the Project Closeout Checklist).

SECTION 01740 - WARRANTIES AND BONDS

1.1 GENERAL

A. Standard product warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

B. Special warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

1. Refer to the General Conditions for terms of the Contractor's period for correction of the Work.
2. Requirements for Warranties and Bonds for products and installations that are specified are included in the individual sections of these specifications.

C. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products. Manufacturer's disclaimers and limitations on product warranties do not relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

D. Related Damages and Losses: When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.

E. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

F. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of the Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefitted from use of the Work through a portion of its anticipated useful service life.

G. Owner's Recourse: Expressed warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights, or remedies.

1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
2. Where the Contract Documents require a special warranty, or similar commitment, the Owner reserves the right to refuse to accept the Work, until the Contractor presents evidence that entities required to countersign such commitments are willing to do so.

H. Submit written warranties to the Architect prior to the date certified for Substantial Completion. If the Architect's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion, submit written warranties upon request of the Architect.

1. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Architect within 15 days of completion of that designated portion of the Work.

I. When the Contract Documents require the Contractor, or the Contractor and a subcontractor, supplier or manufacturer to execute a special warranty, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner, through the Architect, for approval prior to final execution.

1. Refer to Divisions 2 through 16 Sections for specific content requirements and particular requirements for submitting special warranties.

J. Bind warranties and bonds in heavy-duty, commercial-quality, durable 3-ring, vinyl-covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (115-by-280-mm) paper.

1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address, and telephone number of the Installer.
2. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project title or name, and name of the Contractor.
3. When warranted construction requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

1.2 PRODUCTS (Not Applicable)
1.3 EXECUTION (Not Applicable)

END OF SECTION 01740

SECTION 01770 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1. Related Documents

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 Summary

A. This Section requires the selective removal, salvage to Owner and/or subsequent offsite disposal of the following:

1. Removal of HVAC equipment and/or relocation of pipes, conduits, ducts and/or other mechanical and electrical work as required and specified in other Divisions.
2. Cutting nonstructural concrete floors and masonry walls for piping, ducts and/or conduits as required to perform the work specified in other Divisions. Refer to the respective mechanical and electrical specification sections for additional demolition requirements.

1.3 Submittals

A. General: Submit the following in accordance with General Conditions of the Contract and Division 1 Specification Section: SUBMITTALS.

B. Schedule indicating proposed sequence of operations for selective demolition work to the Construction Manager for review prior to start of work. Include coordination for shutoff, capping, and continuation of utility services as required, together with details for dust and noise control protection.

1. Provide a detailed sequence of demolition and removal work to ensure uninterrupted progress of Owner's on-site operations.
2. Coordinate with Owner's continuing occupancy of portions of existing building and site.

C. Photographs of existing conditions of structures, HVAC equipment and adjacent improvements that might be misconstrued as damage related to removal operations. File with Owner's Representative prior to start of work.

1.4 Job Conditions

A. Condition of Structures: Owner assumes no responsibility for actual condition of structures to be demolished.

1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner insofar as practicable. However, variations within structure may occur by Owner's removal and salvage operations prior to start of demolition work.

B. Partial Demolition and Removal: Items indicated to be removed but of salvageable value to Contractor may be removed from structure as work progresses. Transport salvaged items from site as they are removed.

1. Storage or sale of removed items will not be permitted on site.

C. Protections: Provide temporary barricades and other forms of protection to protect Owner's personnel and general public from injury due to selective demolition work.

1. Erect temporary covered passageways as required by authorities having jurisdiction.
2. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of structures to be demolished and adjacent facilities to remain.
3. Protect from damage existing finish work that is to remain in place that becomes exposed during selective demolition operations.
4. Protect floors with suitable coverings to protect from demolition activities.
5. Construct temporary insulated dust-proof partitions where required to separate areas where noisy or extensive dirt or dust operations are performed. Equip partitions with dust-proof doors and security locks.
6. Provide temporary weather protection during interval between demolition and removal of existing construction on exterior surfaces and installation of new construction to ensure that no water leakage or damage occurs to structure or interior areas of existing building.
7. Remove protections at completion of work.
8. Provide protective measures as required to provide free and safe passage of Owner's personnel and general public to occupied portions of building.

D. Damages: Promptly repair damages caused to adjacent facilities by selective demolition operations.

E. Traffic: Conduct selective demolition operations and debris removal of to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close, block or otherwise or obstruct streets, walks, or other occupied or used facilities without permission from the Owner or the authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

F. Flame Cutting: Do not use cutting torches for removal until work area is cleared of flammable materials. At concealed spaces, such as interior of ducts and pipe spaces, verify condition of hidden space before starting flame-cutting operations. Maintain portable fire suppression devices during flame-cutting operations.

G. Utility Services: Maintain existing utilities indicated to stay in service and protect against damage during selective demolition operations.

1. Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to governing authorities. **WATER SERVICE MUST REMAIN UNINTERRUPTED TO ALL PORTIONS OF THE BUILDING(S) AND SITE.**

2. Maintain fire protection services during selective demolition operations.

H. Environmental Controls: Use water sprinkling, temporary enclosures and other methods to limit dust and dirt migration. Comply with governing regulations pertaining to environmental protection.

1. Do not use water when it may cause damage or create hazardous or objectionable conditions such as ice, flooding and pollution.

I. Occupancy: Owner will occupy portions of the building immediately adjacent to areas of selective demolition. Conduct selective demolition work in manner that will minimize need for disruption of Owner's normal operations. Provide minimum of 72 hours advanced notice to Owner of demolition activities that will affect Owner's normal operations.

PART 2 - ITEMS TO BE SALVAGED AND RETAINED AS PROPERTY OF THE OWNER

A. Items to be relocated/reset or turned over to the Owner, shall be safely stored by the Contractor until relocation or turning over to the Owner is possible. Owner shall have first right of refusal for RTUs prior to removal from site.

PART 3 – EXECUTION

3.1 Preparation

A. General: Provide interior and exterior shoring, bracing or support to prevent movement, settlement or collapse of areas to be demolished and adjacent facilities to remain.

1. Cease operations and notify the Construction Manager immediately if safety of structure appears to be endangered. Take precautions to support structure until determination is made for continuing operations.

2. Cover and protect furniture, equipment and fixtures from spoilage or damage when demolition work is performed in areas where such items have not been removed.

3. Erect and maintain dust-proof partition and closures as required to prevent spread of dust or fumes to occupied portions of the building.

a. Provide weatherproof closures for exterior openings resulting from demolition work.

b. Where selective demolition occurs immediately adjacent to occupied portions of the building, construct dust-proof partitions of minimum 4-inch studs, ⅝-inch drywall (joints taped) on occupied side, ½-inch fire retardant plywood on demolition side. Fill partition cavity with sound deadening insulation.

4. Locate, identify, stub off and disconnect utility services that are not indicated to remain.

a. Provide bypass connections as necessary to maintain continuity of service to occupied area of building. Provide minimum of 72 hours advance notice to Owner if shutdown of service is necessary during changeover.

3.2 Demolition

A. General: Perform selective demolition work in a systematic manner. Use such methods as required to complete work indicated on Drawings in accordance with demolition schedule and governing regulations.

1. Locate demolition equipment throughout structure and promptly remove debris to avoid imposing excessive loads on supporting walls, floors, or framing.
2. Provide services for effective air and water pollution controls as required by local authorities having jurisdiction.

B. If unanticipated mechanical, electrical or structural elements that conflict with intended function or design are encountered, investigate and measure both nature and extent of the conflict. Submit report to Owner's Representative in written accurate detail. Pending receipt of directive from Owner's Representative, rearrange selective demolition schedule as necessary to continue overall job progress without undue delay.

C. Vermin Control: Employ a certified, licensed exterminator and treat entire area of building demolition and removal as well as entire area of all building additions in accordance with governing health regulations for rodent and insect control.

3.3 Salvaged Materials

A. General: Salvaged Items are those so indicated on Drawings or Schedules, or as listed in this Section. Carefully remove salvaged items; clean and protect until disposition.

1. Items to be incorporated into new work: Store until required for installation or for required modification or restoration.
2. Other salvage items: Turn over to Owner and obtain receipt.

B. Salvage items damaged during demolition shall be replaced by the Contractor with equivalent new items at no cost to the Owner.

3.4 Disposal of Demolished Materials

A. General: Remove from building site debris, rubbish and other materials resulting from demolition operations. Transport and legally dispose off-site.

1. If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws and ordinances concerning removal, handling and protection against exposure or environmental pollution.

2. Burning of removed materials is not permitted on project site.

3.5 Cleanup and Repair

A. General: Upon completion of demolition work, remove tools, equipment and demolished materials from site. Remove protections and leave interior areas broom clean.

1. Repair demolition performed in excess of that required. Return elements of construction and surfaces to remain to condition existing prior to start of operations. Repair adjacent construction or surfaces soiled or damaged by selective demolition work.

END OF SECTION 01770

WHITESTONE
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March 15, 2023

via email

ARH ASSOCIATES
215 Bellevue Avenue
P.O. Box 579
Hammonton, New Jersey 08037

Attention: Carolyn A. Feigin, PE, PP
Senior Associate

**Regarding: EXISTING PAVEMENT EVALUATION &
LIMITED GEOTECHNICAL INVESTIGATION
PROPOSED SITE IMPROVEMENTS
880 N.J.S.H. ROUTE 45
WOODSTOWN, SALEM COUNTY, NEW JERSEY
WHITESTONE PROJECT NO.: GS2319982.000**

Dear Ms. Feigin:

Whitestone Associates, Inc. (Whitestone) is pleased to submit this report regarding the results of the existing pavement condition evaluation and limited geotechnical investigation conducted at the above-referenced site. The results of field activities and recommendations for the proposed reconstruction, related earthwork, and pavement rehabilitation and/or maintenance are presented below.

1.0 PROJECT DESCRIPTION

1.1 Site Location, Existing Conditions, and Proposed Construction

The subject site located at 880 New Jersey State Highway (N.J.S.H.) Route 45 in Woodstown, Salem County, New Jersey currently houses the Salem County Career and Technical High School with associated pavements, landscaped areas, and utilities.

Based on the February 11, 2022 *Architectural Plan Set* prepared by Garrison Architects and correspondence with ARH Associates, the proposed reconstruction is anticipated to include an approximately 1,500-square feet (footprint) building addition with new pavements, landscaped areas, and utilities as well as improvements to existing site pavements. Detailed grading information was not provided at the time of this report, however, Whitestone anticipates that the site will be redeveloped at or near existing grades. Maximum column loads for the proposed building addition are anticipated to be less than 75 kips.

Based on correspondence with ARH Associates, the existing pavements are in poor condition with areas of significant cracking, settlement, and raveling. Whitestone conducted an existing pavement evaluation including borings and core sampling within existing pavement areas to assess the existing pavement and underlying subbase thicknesses and subsurface conditions within the existing pavement areas. An existing visual pavement evaluation also was conducted to confirm the condition of the existing pavement.

Based on a review of historic aerial photography, the current site layout appears to have been constructed sometime between 1970 and 1981. Based on this information, asphaltic concrete (AC) pavement has been in place at the site well over 20 years, however, historical maintenance and/or replacement records were not available for review.

1.2 Geology

The subject site is situated within the Atlantic Coastal Plain Physiographic Province of New Jersey. Specifically, the site is underlain by the Tertiary-age, Lower member of the Kirkwood Formation. The Lower member of the Kirkwood Formation consists of light yellow to white, massive to thick bedded, fine to medium grained sands interbedded with clay. Locally, areas encountered in near-surface beds are very micaceous and extensively stained by iron oxides. The thick bedded strata commonly consist of interbedded fine grained, micaceous sand and gravelly, coarse to fine grained sand. Overburden materials include manmade fill associated with past and present site development.

2.0 AC PAVEMENT DISTRESS MECHANISMS

AC pavement is unique in comparison to other pavement types because of flexibility and ability to distribute loading. AC pavement achieves flexibility from asphalt cement that binds aggregate particles to create asphalt concrete. Asphalt cement is a sticky, black, and highly viscous liquid or semi-solid form of petroleum. In general, as asphalt cement ages, viscosity increases and the material becomes more stiff and brittle (cement fatigue) resulting in AC pavement cracking. In addition to aging, pavement distress can result from other factors, or combination of, including excessive traffic loading, repeated temperature change, environmental effects, inadequate design, impeded drainage, and subgrade soil failure. Additionally, unrepaired pavement cracks allow water to penetrate the soil subgrade materials and in turn can result in strength loss of the subgrade soils and subsequent pavement distress.

The understanding of pavement distress occurrence is important to develop the appropriate rehabilitation strategy, enhance a pavement performance, and extend the service life. In general, most AC pavements are designed for a service life of approximately 15 years to 20 years with regular maintenance. Additionally, the understanding of the owner's expectation regarding the pavement appearance and life-service enhancement also is considered for the development of the pavement rehabilitation program.

3.0 SCOPE OF SERVICES

Whitestone's services included conducting a visual evaluation to assess the pavement condition, conducting six soil borings (identified as B-1 through B-6), and collecting 10 asphaltic concrete cores (identified as C-1 through C-10) within the existing/proposed reconstruction and pavement areas to evaluate the composition, thickness, and consistency of the underlying subgrade materials. The information obtained was used to analyze the structural capacity of the existing pavement section and to evaluate various repair and/or rehabilitation methods to enhance pavement performance.

The visual evaluation included mapping and quantifying apparent distress types, severity, and locations. The results of the condition survey were combined to formulate an overall pavement condition index (good, fair, and poor) for the existing pavement. The overall condition index is helpful for identifying patterns of distress severity and is useful toward developing appropriate rehabilitation strategies and maintenance programs.

General descriptions of pavement distress types, severity levels and overall condition index are provided on the attached *Pavement Condition Survey* included as Appendix C. Detailed mapping of individual pavement survey areas is provided on the attached *Boring/Core/Pavement Evaluation Plan* included as Figure 1.

The soil borings were advanced with a truck-mounted drill rig using hollow stem augers and split-spoon sampling techniques and were terminated at depths ranging from approximately 10 feet below ground surface (fbgs) to 25 fbgs and were backfilled with excavated soils generated from the investigation and restored with asphaltic cold patch. The locations of the subsurface tests are shown on the *Boring/Core/Pavement Evaluation Plan* included as Figure 1.

The subsurface tests were conducted in the presence of Whitestone personnel who conducted field tests, recorded visual classifications, and collected samples of the various strata encountered. The test locations were located in the field using normal taping procedures and estimated right angles. These locations are presumed to be accurate within a few feet.

Soil borings and Standard Penetration Tests (SPTs) were conducted in general accordance with ASTM International (ASTM) designation D 1586. The Standard Penetration Resistance value (N) can be used as an indicator of the consistency of fine-grained soils and the relative density of coarse-grained soils. The N-value for various soil types can be correlated with the engineering behavior of earthworks and foundations.

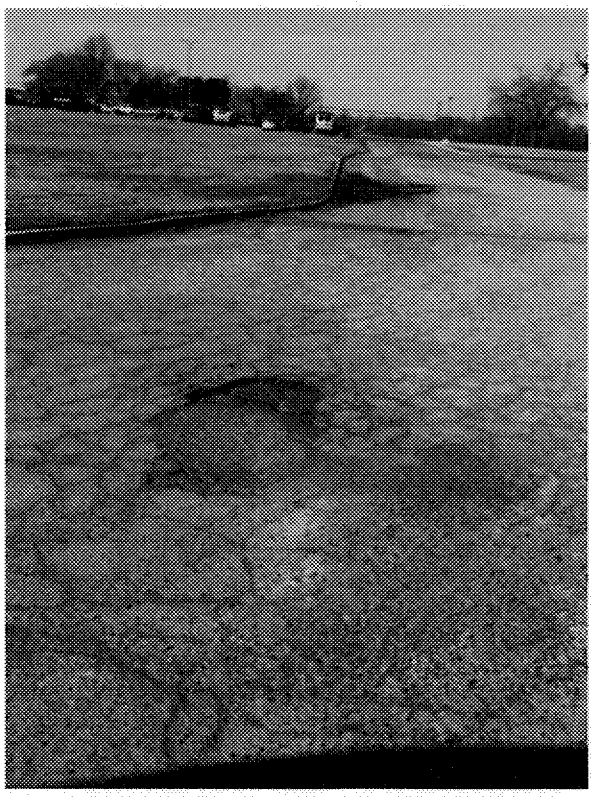
Groundwater level observations, where encountered, were recorded during and immediately following the completion of the testing operations within the soil borings. Seasonal variations, temperature effects, and recent rainfall conditions may influence the levels of the groundwater, and the observed levels will depend on the permeability of the soils. Groundwater elevations derived from sources other than seasonally observed groundwater monitoring wells may not be representative of true groundwater levels.

4.0 SUMMARY OF FINDINGS

Visual Evaluation: The results of the visual evaluation indicated that the existing asphaltic concrete pavement area generally is in very poor to fair structural condition with areas generally exhibiting low to high severity distress including longitudinal/transverse cracking, alligator cracking, raveling, and potholes.

The predominant stress types observed consisted of longitudinal/transverse cracking, potholes, and alligator cracking, as shown in the photographs below.

Pavement Distress Photograph 1 - Grid 3



Pavement Distress Photograph 2 - Grid 14

Pavement Summary: The results obtained from the soil borings and asphaltic pavement coring efforts indicate that the thickness of the existing asphaltic concrete pavement ranged between approximately four inches to 6.5 inches. Approximately half of the subsurface tests encountered subbase materials consisting of up to approximately 2.5 inches of crushed stone. The results of the existing pavement coring efforts are presented in the following table and provide general thicknesses of the existing pavement sections:

SUMMARY OF PAVEMENT SECTIONS				
Test Location	Grid Location	Total Pavement Thickness (Inches)	Subbase Thickness (Inches)	Subgrade Material (USCS)
B-1/C-1	Grid 1	5.5	2.0	GP (FILL)
C-2	Grid 1	4.5	1.0	CL
C-3	Grid 3	5.0	2.0	CL
B-2/C-4	Grid 4	4.5	2.0	SM (FILL)
B-3/C-5	Grid 8	4.0	2.5	GP (FILL)
C-6	Grid 9	6.5	Not Encountered	SP
B-4/C-7	Grid 10	6.0	Not Encountered	CL (FILL)
C-8	Grid 11	4.5	Not Encountered	SP
C-9	Grid 15	5.25	Not Encountered	SM
C-10	Grid 12	4.0	Not Encountered	CL
B-5	Grid 12	4.0	Not Encountered	SM
B-6	Grid 12	4.0	Not Encountered	SC

Subsurface Conditions: The subsurface soil conditions encountered in the soil borings consisted of the following generalized strata in order of increasing depth. *Records of Subsurface Exploration* are provided in Appendix A.

Surface Materials: The soil borings were conducted within the existing pavement areas. A summary of the asphalt and subbase thicknesses, where encountered, is provided in the table above.

Existing Fill: Underlying the surface materials, the soil borings, with the exception of B-5 and B-6, encountered existing fill that generally consisted of a mixture of sand, silt, clay, and gravel. Where encountered, the existing fill extended to depths ranging from approximately one fbgs to four fbgs. SPT N-values within the existing fill ranged between six blows per foot (bpf) and 23 bpf and averaged approximately 12 bpf.

Coastal Plain Deposits: Beneath the surface cover and/or existing fill, the soil borings encountered alluvial deposits generally consisting of silt, elastic silt, and lean clay with variable amounts of sand (USCS: ML, MH, CL, and CL-ML) and occasional pockets of poorly graded sand (USCS: SP) and clayey sand (USCS: SC). The soil borings were terminated within the coastal plain deposits at depths ranging from approximately 10 fbgs to 25 fbgs. SPT N-values within the coarse-grained portions of this stratum ranged between two bpf and 14 bpf, indicating a very loose to medium dense relative density and averaged approximately eight bpf. Pocket penetrometer tests conducted on the cohesive natural soils indicated

unconfined compression strength values ranging between approximately 0.25 tons per square foot (tsf) and two tsf, generally indicating very soft to stiff soil consistencies, with a majority within soft to very soft consistencies.

Groundwater: Static groundwater was encountered within the deeper soil borings conducted (B-5 and B-6) at a depth of approximately 18 fbgs. Seasonal variations, temperature effects, man-made effects and recent rainfall conditions may influence the levels of the groundwater, and the observed level will depend on the permeability of the soils. Groundwater elevations derived from sources other than seasonally observed groundwater monitor wells may not be representative of true groundwater level.

Soil Laboratory Analysis: In addition to the field investigation, a laboratory program was conducted to determine additional, pertinent engineering characteristics of representative samples of on-site soils. The laboratory program was conducted in general accordance with applicable ASTM standard test methods and included physical/textural testing of representative samples of various strata.

The results of the laboratory program are presented in this section in a general manner and qualitatively interpreted. The results are incorporated into the findings and recommendations discussed throughout this report. Quantitative test results are provided in Appendix B.

A representative sample of a selected strata encountered was subjected to a laboratory program that included moisture content determinations (ASTM D-2216) and washed gradation analyses (ASTM D-422) in order to conduct supplementary engineering soil classifications in general accordance with ASTM D-2487. The soil strata tested were classified by the Unified Soil Classification System (USCS) and results of the laboratory testing are summarized in the following table.

SUMMARY OF LABORATORY TEST RESULTS								
Test Location	Sample No.	Depth (fbgs)	USCS Classification	Atterberg Limits			Natural Moisture (%)	Material Finer Than #200 Sieve (%)
				LL	PL	PI		
B-6	S-4/S-5	6.0 - 10.0	MH	51	41	10	42.9	91.9

Additionally, a California Bearing Ratio (CBR) test was conducted on the composite sample taken from the existing subgrade soil in general accordance with ASTM D 1883. The CBR value is used in conjunction with climatic factor and design loads to design an appropriate pavement section. A laboratory CBR value of 2.5 was obtained from the composite bulk sample.

A moisture-density relationship per ASTM D 1557 also was conducted. The maximum dry density and optimum moisture content were obtained from the peak value of the moisture-density curve. The maximum dry density and optimum moisture content on the tested sample was 117.7 pounds per cubic foot (pcf) at 13.4 percent. More detailed quantitative results are provided in Appendix B.

5.0 CONCLUSIONS & RECOMMENDATIONS

The results of the pavement condition evaluation indicated that the existing asphaltic concrete pavement area is at the end of its design life and generally is in fair to very poor structural condition. Therefore, full depth asphalt replacement or new rigid pavement is recommended to support the proposed site improvements. Due to the underlying fine-grained soils and elastic silt soils (USCS: MH) encountered poor subgrade workability and increased maintenance of proposed pavement areas should be anticipated as discussed herein.

Following overexcavation of elastic silts below proposed foundations and floor slabs as recommended herein, Whitestone recommends supporting the proposed building addition on conventional shallow foundations and ground-supported floor slabs bearing within the improved non-elastic portions of the underlying natural soils and/or controlled structural fill soils provided they are properly inspected, placed and compacted in accordance with Sections 5.2, 5.4, and 5.6 of this report.

5.1 Full-Depth Pavement Replacement

Whitestone recommends conducting full-depth pavement replacement within the proposed pavement areas. The new AC pavement sections should conform to the table below. The full-depth repair procedure will require saw cutting existing pavement areas and completely removing the existing AC pavement required to install the recommended pavement section below. Based on the results of the investigation, the majority of the existing subgrade soils, with the exception of elastic silt (USCS: MH) materials, are anticipated to be marginally suitable for reuse as pavement subgrade following compaction to a firm and stable condition and inspected by the owner's geotechnical engineer, including conducting a proofroll inspection. Elastic silts encountered at the proposed pavement subgrade should be overexcavated to a minimum depth of 12 inches below proposed subgrade elevations. Additionally, any localized areas of soft or unsuitable soil/material revealed by compaction and/or proofrolling, should be overexcavated and replaced with approved granular fill as noted in Section 5.2. Due to the underlying elastic silts encountered, increased maintenance of proposed pavement areas should be anticipated. The cut edges of repair areas should be treated with a tack coat prior to placing the required pavement section.

Design Criteria: A CBR value of 1.5 has been assigned to the properly prepared subgrade soils for pavement design purposes based on laboratory test results and climatic factors. This value was correlated with pertinent soil support values and assumed traffic loads to prepare flexible and rigid pavement designs per the AASHTO *Guide for the Design of Pavement Structures*.

Design traffic loads were assumed based on typical volumes for similar facilities and correlated with 18-kip equivalent single axle loads (ESAL) for a 20-year life. An estimated maximum load of 35,000 ESAL was for standard pavement areas and 500,000 ESALs was used for heavy duty pavement areas.

Pavement Sections: The minimum recommended full-depth pavement sections are presented below in tabular format.

RECOMMENDED FULL-DEPTH FLEXIBLE PAVEMENT SECTION			
Layer	**Material**	**Standard Duty Thickness (Inches)**	**Heavy Duty Thickness (Inches)**
Asphalt Surface	NJDOT I-5 Surface	2.0	2.0
Asphalt Base	NJDOT I-2 Base	3.0	4.5
Granular Subbase	NJDOT DGA Base Course	6.0	9.0

Note[1]: The recommended pavement section thicknesses above will likely require undercutting the existing subgrade in order to maintain existing surface grades (if desired) and may result in off-site disposal of excess soils.

Additional Design Considerations: The pavement section thickness designs presented in this report are based on the design parameters detailed herein and are contingent on proper construction, inspection, and maintenance. Additional pavement thickness may be required by local code. The designs are contingent on achieving the minimum soil support value in the field. To accomplish this requirement, all subgrade

soil and supporting fill or backfill must be placed, compacted, and evaluated in accordance with the recommendations provided in this report. Proper drainage must be provided for the pavement structure including appropriate grading and surface water control.

The performance of the pavement also will depend on the quality of materials and workmanship. Whitestone recommends that NJDOT standards for materials, workmanship, and maintenance be applied to this site. Project specifications should include verifying that the installed asphaltic concrete material composition is within tolerance for the specified materials and that the percentage of air voids of the installed pavement is within specified ranges for the respective materials. All rigid concrete pavements should be suitably air-entrained, jointed, and reinforced.

The recommended pavement section thicknesses above will likely require undercutting the existing subgrade in order to maintain existing surface grades (if desired) and may result in off-site disposal of excess soils.

5.2 Site Preparation & Earthwork

Surface Cover Stripping: Prior to stripping operations, all utilities should be identified and secured. The existing pavements to be stripped should be removed from within the limits of the proposed new construction areas, as necessary. All stripping and earthwork activities operations should be conducted in a manner consistent with good erosion and sediment control practices.

Surface Preparation/Proofrolling: Prior to new pavement and fill/subbase material placement, the exposed subgrade should be compacted with a minimum 10-ton vibratory roller and proof-rolled with a loaded tandem-axle truck to identify potential soft or loose soil conditions that may require additional compaction or removal and replacement. The roller should be operated in the static mode or a kneading "sheepsfoot" roller should be used if silt and/or clay soils are encountered at subgrade elevations. Elastic silts (USCS: MH) if encountered at the proposed pavement and floor slab subgrades should be overexcavated to a minimum depth of 12 inches below proposed subgrade elevation and resulting excavations should be restored with approved, controlled structural fill materials. Alternatively, the proposed subgrade may be stabilized chemically via a lime or cement additive because the underlying subgrade soils will soften if exposed to wet weather or repeated heavy construction traffic, excavation and fill placement procedures should be conducted during favorable weather conditions. Any fill or backfill should be placed and compacted in accordance with Section 5.2.

Subgrade Stabilization and Inspection: Subgrade soils that are exposed to inclement weather, including precipitation, and heavy construction traffic will degrade and require either extensive drying time or overexcavation and replacement in order to provide a suitable subgrade for pavements. Overexcavation of unstable soils within pavement areas typically should be limited to approximately 1.5 feet below planned subgrade unless directed otherwise by the owner's geotechnical engineer, provided that a reinforcing geogrid approved by the owner's geotechnical engineer is used. Alternatively, the proposed subgrade may be stabilized chemically via a lime or cement additive.

Geogrids typically are economical when proposed undercut depths exceed approximately 16 inches. The geogrid (Tensar TriAx TX130S or approved equivalent) should be placed directly on the exposed subgrade, pulled tightly and subsequently backfilled. Backfill should consist of a well-graded gravel and sand blend. The services of the geotechnical engineer should be retained to inspect soil conditions during construction and to provide specific recommendations for stabilizing subgrades. Additionally, a geotechnical engineer should be retained to verify the suitability of prepared pavement subgrades for support of design loads.

Imported Fill Material: Any imported material placed as structural fill or backfill to raise elevations or restore design grades should consist of clean, relatively well graded sand or gravel with a maximum particle size of two inches and five percent to 15 percent of material finer than a #200 sieve. Silts, clays, and silty or clayey sands and gravels with higher percentage of fines and with a liquid limit less than 40 and a plasticity index less than 20 may be considered subject to the owner's approval, provided that the required moisture content and compaction controls are met during favorable weather conditions. The material should be free of clay lumps, organics, and deleterious material. Imported structural fill material should be approved by a qualified geotechnical engineer prior to delivery to the site.

Soil Reusability: Whitestone anticipates that the majority of the existing fill and underlying natural site soils will be suitable for selective reuse as structural backfill materials will be suitable for selective reuse as structural fill or backfill contingent on careful inspection in the field by the owner's geotechnical engineer through visual observation and laboratory testing during construction in accordance with the recommendations provided in this report, moisture control, and segregation of any deleterious debris and objectionable debris if encountered. Elastic silts (USCS: MH) if encountered at the proposed pavement and floor slab subgrades should be overexcavated to a minimum depth of 12 inches below proposed subgrade elevation and resulting excavations should be restored with approved, controlled structural fill materials. Extensive drying prior to reuse of on-site soil should be expected. Materials that are, or become, exceedingly wet will require discing and aerating and extended time to dry during extended periods of warm, dry weather. Immediate re-use of site soils with a higher percentage of fine-grained material should not be anticipated and moisture control, such as discing, should be expected prior to re-use.

Alternatively, imported fill materials may be used to attain the desired grades and expedite earthwork operations during wet weather periods. In addition, allotments in the project schedule, budget, and site area should be provided for soil moisture control and segregation. The use of imported material should be anticipated and included in the site work budget. Stripped surface cover materials should not be used as general fill or backfill.

Compaction and Placement Requirements: All fill and backfill should be placed in maximum nine-inch loose lifts and compacted to 95 percent of the maximum dry density within two percent of the optimum moisture content as determined by ASTM D 1557 (Modified Proctor). Whitestone recommends using a smooth drum roller to compact imported and on-site soils granular soils or kneading roller (sheepsfoot) to compact cohesive soils. The drum roller should be used in static mode when compacting clay or silt soils.

Structural Fill Testing: A sample of the imported fill material or any on-site material proposed for reuse as structural fill or backfill should be submitted to the geotechnical engineer for analysis and approval at least one week prior to its use. The placement of all fill and backfill should be monitored by a qualified engineering technician to ensure that the specified material and lift thicknesses are properly installed. A sufficient number of in-place density tests should be conducted to ensure that the specified compaction is achieved throughout the height of the fill or backfill.

5.3 Groundwater Control

Static groundwater was encountered within the deeper borings conducted at a depth of approximately 18 fbgs. Perched/trapped groundwater may be encountered following periods of wet weather within the existing fill, at the existing fill /natural soil interface, and within fine-grained portions of the natural site soils. As such, Whitestone does not anticipate the need for permanent groundwater control, however, depending on the time of year and/or the precipitation conditions, temporary dewatering of run-off or trapped water may be required during construction. Minor dewatering of surface runoff, infiltrating water or trapped water typically may be controlled by providing a sufficient number of sump pumps at the base

of the excavations. Since excessive amounts of perched groundwater may accumulate during periods of wet weather, Whitestone recommends that the proposed site improvements occur during periods of relatively dry weather.

Because the subsurface soils will soften when exposed to water, every effort must be made to maintain drainage of surface water runoff away from construction areas by grading and limiting the exposure of excavations to rainfall. Overexcavation of saturated soils and replacement with controlled structural fill and/or one foot to two feet of open graded gravel (such as 3/4-inch clean crushed stone) may be required prior to resuming work on disturbed subgrade soils.

5.4 Foundation Design Criteria

Foundations: Following overexcavation of elastic silts (USCS: MH) encountered at or below proposed foundation elevations to a depth of at least four feet below final grades, Whitestone recommends supporting the proposed building addition on conventional spread and continuous wall footings designed to bear within the improved and approved site soils, and/or on properly placed and compacted structural fill provided these materials are properly evaluated, placed, and compacted in accordance with Sections 5.2, 5.4, and 5.5 of this report. Elastic silts are anticipated to be encountered to a maximum depth of approximately 13 fbgs within the proposed building addition. The overexcavation should be restored with granular structural fill per Section 5.6. Foundations bearing within these materials may be designed using a maximum allowable net bearing pressure of 2,000 pounds per square foot (psf).

Reuse of the existing fill for foundation support will be contingent upon supplemental evaluation, as described in Section 5.6. All footing bottoms should be improved by in-trench compaction in the presence of the geotechnical engineer. Regardless of loading conditions, proposed foundations should be sized no less than minimum dimensions of 24 inches for continuous wall footings and 36 inches for isolated column footings.

Below-grade footings and footings subject to overturning should be designed so that the maximum toe pressure due to the combined effect of vertical loads and overturning moment does not exceed the recommended maximum allowable net bearing pressure. In addition, positive contact pressure should be maintained throughout the base of the footings such that no uplift or tension exists between the base of the footings and the supporting soil. Eccentrically-loaded footings should be evaluated by the geotechnical engineer. Uplift loads should be resisted by the weight of the concrete. Side friction should be neglected when proportioning the footings so that lateral resistance should be provided by friction resistance at the base of the footings. A coefficient of friction against sliding of 0.35 is recommended for use in the design of the foundations bearing within the natural site soils or imported structural fill soils.

Seismic Site Class: Based on a review of the subsurface conditions relevant to the *2021 International Building Code – New Jersey Edition*, the subject site has been assigned a Site Class D. Based on the seismic zone and soil profile, liquefaction considerations are not expected to have a substantial impact on design.

Inspection/Overexcavation Criteria: Whitestone recommends that the suitability of the bearing soils along and below the foundation bottoms be verified by a geotechnical engineer prior to placing concrete. In the event that areas of unsuitable materials are encountered, such as deleterious existing fill and elastic silt soils, overexcavation and replacement of the materials will be necessary to provide a suitable footing subgrade. Any overexcavation to be restored with structural fill will need to extend at least one foot laterally beyond footing edges for each vertical foot of overexcavation. Lateral overexcavation may be reduced if grade is restored with lean concrete. The bottom of overexcavations should be compacted with vibrating plates or plate tampers ("jumping jacks") to compact locally disturbed materials.

Frost Coverage/Adjacent Foundations: Footings subject to frost action should be placed at least 30 inches below adjacent exterior grades or the depth required by local building codes to provide protection from frost penetration. Interior footings not subject to frost action may be placed at a minimum depth of 18 inches below the slab subgrade. Care should be exercised during construction to avoid undermining the existing adjacent foundations.

Settlement: Whitestone estimates post construction settlements of proposed foundations of less than one inch if the recommendations outlined in this report are properly implemented. Differential settlement of foundations should be less than one-half inch.

5.5 Floor Slab

Following supplemental evaluation of the existing fill, Whitestone anticipates that improved and approved and improved existing fill, underlying natural soils (except for elastic silt soils), and/or controlled structural fill materials will be suitable for support of the proposed floor slab provided these materials are properly evaluated, placed, compacted and proofrolled in accordance with Sections 5.2, 5.3, and 5.11 of this report. Areas of overexcavation may be anticipated due to the inherent variability that exists within the existing fill and/or if the subgrades are exposed to precipitation. Elastic silt soils (USCS: MH) should be overexcavated if encountered below proposed floor slabs, backfilled in accordance with Section 5.2 of this report, and limited to non-structural areas or in areas directed by the owner's geotechnical engineer due to moderate potential for shrink/swell. Any areas that become softened or disturbed as a result of wetting and/or repeated exposure to construction traffic should be removed and replaced with compacted structural backfill. The properly prepared on-site soils are expected to yield a minimum subgrade modulus (k) of 150 psi/in.

5.6 Supplemental Post Investigation Services

Construction Phase Evaluation of Existing Fill: Contingent upon construction phase evaluation of the existing fill, Whitestone anticipates that the existing fill improved via in-place compaction may be suitable for foundation support without risk of intolerable total and differential settlement. The existing fill may be suitable for floor slab and pavement support with limited overexcavation, due to the inherent variability within existing fill. Whitestone also anticipates that the majority of the existing fill will be suitable for selective reuse as structural fill where free of deleterious debris and implementation of moisture control operations are utilized. Reuse of the existing fill will be contingent on careful inspection in the field by the owner's geotechnical engineer by visual observation during construction as recommended herein. Due to the inherent variability that exists within existing fill, Whitestone recommends confirming further the condition of the existing fill for foundation, floor slab support and/or re-use as structural fill by means of supplemental evaluation prior to or during the early stages of construction, as discussed further herein, to identify areas requiring removal and possible uncontrolled conditions or deleterious materials not disclosed by the subsurface tests conducted during limited exploration.

Construction Inspection and Monitoring: The owner's geotechnical engineer with specific knowledge of the subsurface conditions and design intent should conduct inspection, testing, and consultation during construction as described in previous sections of this report. Monitoring and testing should also be conducted to verify that the existing structures are properly demolished, any encountered underground structures, such as the existing building foundations, are properly backfilled, the existing surface cover materials are properly removed, and suitable materials are used for controlled fill are properly placed and compacted over suitable subgrade soils. The overexcavation of elastic silt soils as recommended herein and proofrolling of all subgrades prior to foundation, floor slab, and pavement support should be witnessed and documented by the owner's geotechnical engineer.

6.0 CLOSING

Whitestone appreciates the opportunity to be of continued service to ARH Associates. Please do not hesitate to contact us with any questions regarding this report.

Sincerely,

WHITESTONE ASSOCIATES, INC.

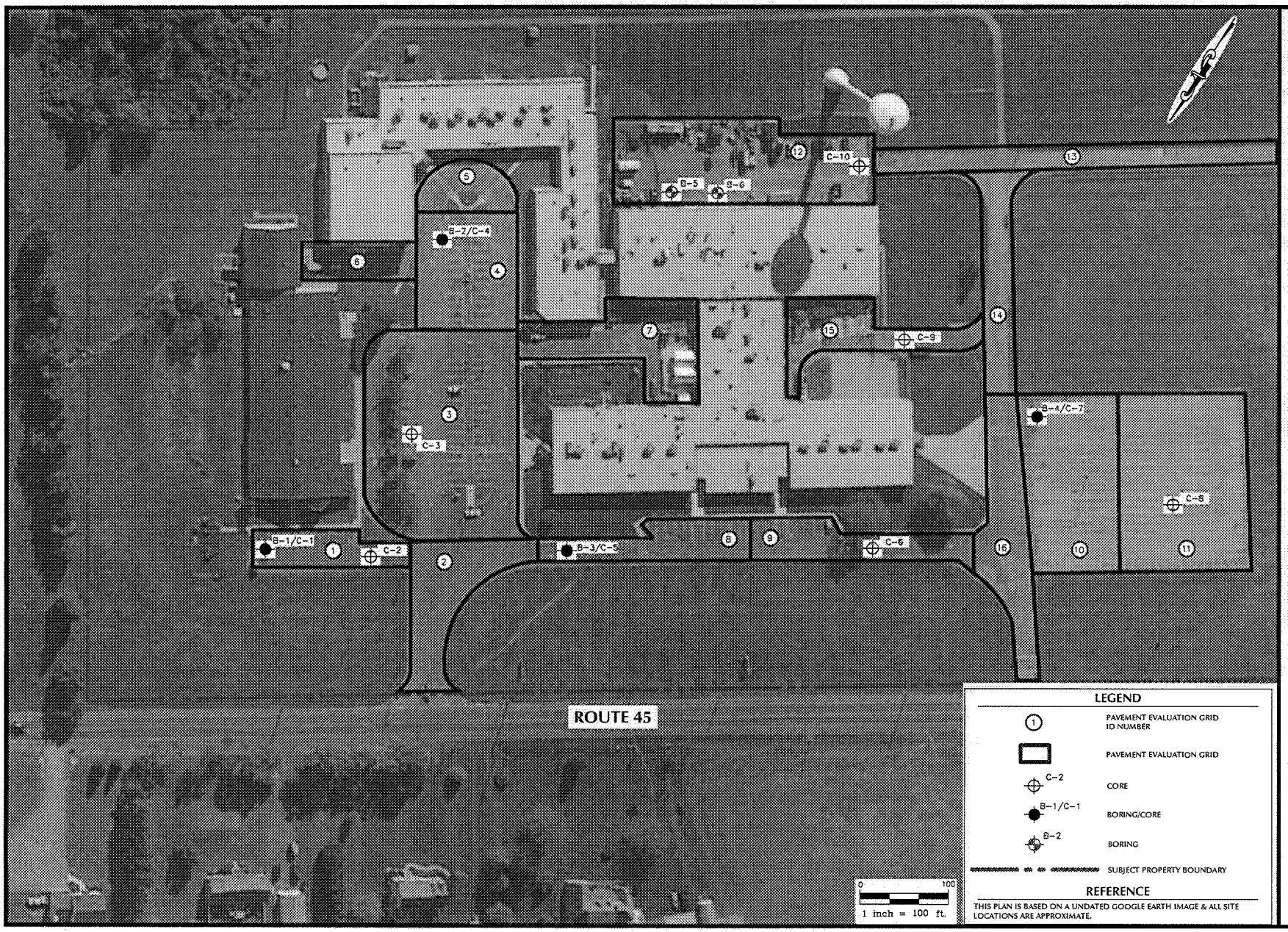
Kyle Kopacz, P.E.
Associate

Laurence W. Keller, P.E.
Vice President

TJ/ri L:\Job Folders\2023\2319982GS\Reports and Submittals\19882 EPE_LimGl.docx
Enclosures

WHITESTONE

FIGURE 1
Boring/Core/Pavement Evaluation Plan



LEGEND

- PAVEMENT EVALUATION GRID ID NUMBER
- PAVEMENT EVALUATION GRID
- C-2 — CORE
- B-1/C-1 — BORING/CORE
- B-2 — BORING
- SUBJECT PROPERTY BOUNDARY

REFERENCE

THIS PLAN IS BASED ON A UNDATED GOOGLE EARTH IMAGE & ALL SITE LOCATIONS ARE APPROXIMATE.

WHITESTONE
An Employee-Owned Company
1959 HIGHWAY 34 BUILDING A, UNIT 102 WALL, NJ 07719
732-592-2101 WHITESTONEASSOC.COM

DRAWING TITLE: BORING/CORE/PAVEMENT EVALUATION PLAN

CLIENT: ARH ASSOCIATES

PROJECT: PROPOSED SITE IMPROVEMENTS
880 ROUTE 45
WOODSTOWN, SALEM COUNTY, NJ

PROJECT #: GS2319982.000	
DESIGNED BY: GR	PROJ. MGR.: KK
DATE: 2/13/23	FIGURE: 1
SCALE: 1" = 100'	

WHITESTONE

APPENDIX A
Records of Subsurface Exploration

WHITESTONE

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-1

Project:	Proposed Site Improvements	**WAI Project No.:**	GS2319982.000
Location:	880 N.J.S.H. Route 45; Woodstown, Salem County, NJ	**Client:**	ARH Associates
Surface Elevation:	± NS feet	**Date Started:**	2/8/2023
Termination Depth:	10.0 feet bgs	**Date Completed:**	2/8/2023
Proposed Location:	Pavement	**Logged By:**	RL
Drill / Test Method:	HSA / SPT	**Contractor:**	AD
		Equipment:	CME-45

Water Depth | Elevation (feet bgs) | (feet)			Cave-In Depth | Elevation (feet bgs) | (feet)	
During:	NE	---		
At Completion:	NE	---	**At Completion:**	8.0 | ---
24 Hours:	---	---	**24 Hours:**	--- | ---

SAMPLE INFORMATION						DEPTH	STRATA	DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)			
						0.0	PAVEMENT	2" Top Course Asphalt, 3.5" Base Course Asphalt, 2" Gravel Subbase	
0.5 - 2	S-1		4 - 3 - 3	15	6	1.0	FILL	Gray Sandy Gravel, Moist (FILL)	
							COASTAL PLAIN DEPOSITS	Light Brown Sandy Lean Clay, Moist, Medium Stiff (CL)	Qu = 1.25 tsf
2 - 4	S-2		4 - 6 - 9 - 9	12	15			As Above (CL)	Qu = 1.5 tsf
4 - 6	S-3		4 - 6 - 8 - 10	1	14	5.0		As Above, Soft (CL)	Qu = 0.5 tsf
						6.0			
6 - 8	S-4		8 - 7 - 6 - 6	12	13			Gray to Orangish-Brown Sandy Silt, Moist, Soft (ML)	Qu = 0.5 tsf
8 - 10	S-5		5 - 5 - 4 - 4	14	9			As Above, Very Soft (ML)	Qu = 0.25 tsf
						10.0		Boring Log B-1 Terminated at a Depth of 10.0 feet Below Ground Surface	
						15.0			
						20.0			
						25.0			

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-2

Page 1 of 1

Project:	Proposed Site Improvements	**WAI Project No.:**	GS2319982.000
Location:	880 N.J.S.H. Route 45; Woodstown, Salem County, NJ	**Client:**	ARH Associates
Surface Elevation:	± NS feet	**Date Started:**	2/8/2023
Termination Depth:	10.0 feet bgs	**Date Completed:**	2/8/2023
Proposed Location:	Pavement	**Logged By:**	RL
Drill / Test Method:	HSA / SPT	**Contractor:**	AD
		Equipment:	CME-45

Water Depth (feet bgs) | Elevation (feet)		Cave-In Depth (feet bgs) | Elevation (feet)	
During:	NE | ---		
At Completion:	NE | ---	**At Completion:**	8.0 | ---
24 Hours:	--- | ---	**24 Hours:**	--- | ---

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0				
						0.5	PAVEMENT		2" Top Course Asphalt, 2.5" Base Course Asphalt, 2" Gravel Subbase	
0.5 - 2	S-1		3 - 5 - 9	10	14		FILL		Brown Silty Sand, Moist (FILL)	Reworked Natural Soil
2 - 4	S-2		18 - 14 - 9 - 6	9	23	4.0			As Above (FILL)	
4 - 6	S-3		6 - 6 - 7 - 8	19	13	5.0	COASTAL PLAIN DEPOSITS		Orangish-Brown Lean Clay, Moist, Stiff (CL)	Qu = 2.0 tsf
6 - 8	S-4		6 - 6 - 8 - 9	9	14				As Above, Soft (CL)	Qu = 0.75 tsf
8 - 10	S-5		5 - 5 - 5 - 6	12	10	10.0			As Above, Very Soft (CL)	Qu = 0.25 tsf
									Boring Log B-2 Terminated at a Depth of 10.0 feet Below Ground Surface	
						15.0				
						20.0				
						25.0				

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-3

Page 1 of 1

Project:	Proposed Site Improvements	**WAI Project No.:**	GS2319982.000
Location:	880 N.J.S.H. Route 45; Woodstown, Salem County, NJ	**Client:**	ARH Associates
Surface Elevation:	± NS feet	**Date Started:**	2/8/2023
Termination Depth:	10.0 feet bgs	**Date Completed:**	2/8/2023
Proposed Location:	Pavement	**Logged By:**	RL
Drill / Test Method:	HSA / SPT	**Contractor:**	AD
		Equipment:	CME-45

Water Depth | Elevation (feet bgs) | (feet)		Cave-In Depth | Elevation (feet bgs) | (feet)	
During:	NE | ---		
At Completion:	NE | ---	**At Completion:**	8.0 | ---
24 Hours:	--- | ---	**24 Hours:**	--- | ---

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No.	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0				
						0.5	PAVEMENT		2" Top Course Asphalt, 2.5" Base Course Asphalt, 2.5" Gravel Subbase	
						1.0	FILL		Gray Sandy Gravel, Moist (FILL)	
0.5 - 2	S-1	X	5 - 5 - 4	12	9		COASTAL PLAIN DEPOSITS		Orangish-Brown Lean Clay, Moist, Soft (CL)	Qu = 0.5 tsf
2 - 4	S-2	X	4 - 5 - 10 - 15	14	15				As Above, Medium Stiff (CL)	Qu = 1.25 tsf
4 - 6	S-3	X	12 - 13 - 7 - 7	NR	20	5.0			No Recovery, Presumed As Above (CL)	
6 - 8	S-4	X	8 - 9 - 10 - 9	18	19				As Above, Soft (CL)	Qu = 0.5 tsf
						8.0				
8 - 10	S-5	X	6 - 6 - 5 - 6	16	11				Orangish-Brown Silt, Moist, Soft (ML)	Qu = 0.5 tsf
						10.0				
									Boring Log B-3 Terminated at a Depth of 10.0 feet Below Ground Surface	
						15.0				
						20.0				
						25.0				

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-4

Page 1 of 1

Project:	Proposed Site Improvements	**WAI Project No.:**	GS2319982.000
Location:	880 N.J.S.H. Route 45; Woodstown, Salem County, NJ	**Client:**	ARH Associates
Surface Elevation:	± NS feet	**Date Started:**	2/8/2023
Termination Depth:	10.0 feet bgs	**Date Completed:**	2/8/2023
Proposed Location:	Pavement	**Logged By:**	RL
Drill / Test Method:	HSA / SPT	**Contractor:**	AD
		Equipment:	CME-45

	Water Depth (feet bgs)	Elevation (feet)	Cave-In Depth (feet bgs)	Elevation (feet)
During:	NE	---		
At Completion:	NE	---	8.0	---
24 Hours:	---	---	---	---

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0				
						0.5	PAVEMENT		1" Top Course Asphalt, 5" Base Course Asphalt, No Apparent Subbase	
0.5 - 2	S-1		4 - 4 - 6	2	10		FILL		Brown Sandy Lean Clay, Moist (FILL)	
						2.0				
2 - 4	S-2		4 - 4 - 8 - 7	15	12		COASTAL PLAIN DEPOSITS		White Silt, Moist, Soft (ML)	Qu = 0.75 tsf
						4.0				
4 - 6	S-3		8 - 2 - 3 - 4	9	5	5.0			White Silty Lean Clay, Moist, Soft (CL-ML)	Qu = 0.5 tsf
						6.0				
6 - 8	S-4		5 - 6 - 7 - 5	14	13				Light Brown Lean Clay, Moist, Very Soft (CL)	Qu = 0.25 tsf
8 - 10	S-5		5 - 4 - 4 - 4	12	8				As Above, Soft (CL)	Qu = 0.5 tsf
						10.0			Boring Log B-4 Terminated at a Depth of 10.0 feet Below Ground Surface	
						15.0				
						20.0				
						25.0				

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-5

Page 1 of 1

Project:	Proposed Site Improvements	**WAI Project No.:**	GS2319982.000
Location:	880 N.J.S.H. Route 45; Woodstown, Salem County, NJ	**Client:**	ARH Associates
Surface Elevation:	± NS feet	**Date Started:**	2/8/2023
Termination Depth:	25.0 feet bgs	**Date Completed:**	2/8/2023
Proposed Location:	Building Pad	**Logged By:**	RL
Drill / Test Method:	HSA / SPT	**Contractor:**	AD
		Equipment:	CME-45

Water Depth (feet bgs) | Elevation (feet)		Cave-In Depth (feet bgs) | Elevation (feet)	
During:	18.0 | ---		
At Completion:	NE | ---	**At Completion:**	12.5 | ---
24 Hours:	--- | ---	**24 Hours:**	--- | ---

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0	PAVEMENT		4" Asphalt, No Apparent Subbase	
						0.3	COASTAL PLAIN DEPOSITS			
0.5 - 2	S-1	X	5 - 7 - 4	6	11				Orangish-Brown Silty Sand, Moist (SM)	
						2.0				
2 - 4	S-2	X	5 - 5 - 7 - 7	12	12				Brown Silt, Moist, Medium Stiff (ML)	Qu = 1.5 tsf
4 - 6	S-3	X	14 - 3 - 3 - 4	8	6	5.0			As Above, Soft (ML)	Qu = 0.5 tsf
						6.0				
6 - 8	S-4	X	4 - 4 - 4 - 6	20	8				Light Brown Lean Clay, Moist, Soft (CL)	Qu = 0.5 tsf
8 - 10	S-5	X	5 - 5 - 6 - 6	10	11				As Above (CL)	Qu = 0.75 tsf
						10.0				
13 - 15	S-6	X	5 - 5 - 5 - 6	3	10				As Above (CL)	Qu = 0.5 tsf
						15.0				
18 - 20	S-7	X	11 - 17 - 9 - 4	6	26				As Above, Wet, Very Soft (CL)	Qu = 0.25 tsf
						20.0				
						23.0				
23 - 25	S-8	X	1 - 1 - 1 - 2	24	2				Brown Poorly Graded Sand, Wet, Very Loose (SP)	
						25.0				
									Boring Log B-5 Terminated at a Depth of 25.0 Feet Below Ground Surface	

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-6

Project:	Proposed Site Improvements	**WAI Project No.:**	GS2319982.000
Location:	880 N.J.S.H. Route 45; Woodstown, Salem County, NJ	**Client:**	ARH Associates
Surface Elevation:	± NS feet	**Date Started:**	2/8/2023
Termination Depth:	25.0 feet bgs	**Date Completed:**	2/8/2023
Proposed Location:	Building Pad	**Logged By:**	RL
Drill / Test Method:	HSA / SPT	**Contractor:**	AD
		Equipment:	CME-45

Water Depth (feet bgs) | Elevation (feet)		Cave-In Depth (feet bgs) | Elevation (feet)	
During:	18.0 | ---		
At Completion:	NE | ---	**At Completion:**	14.0 | ---
24 Hours:	--- | ---	**24 Hours:**	--- | ---

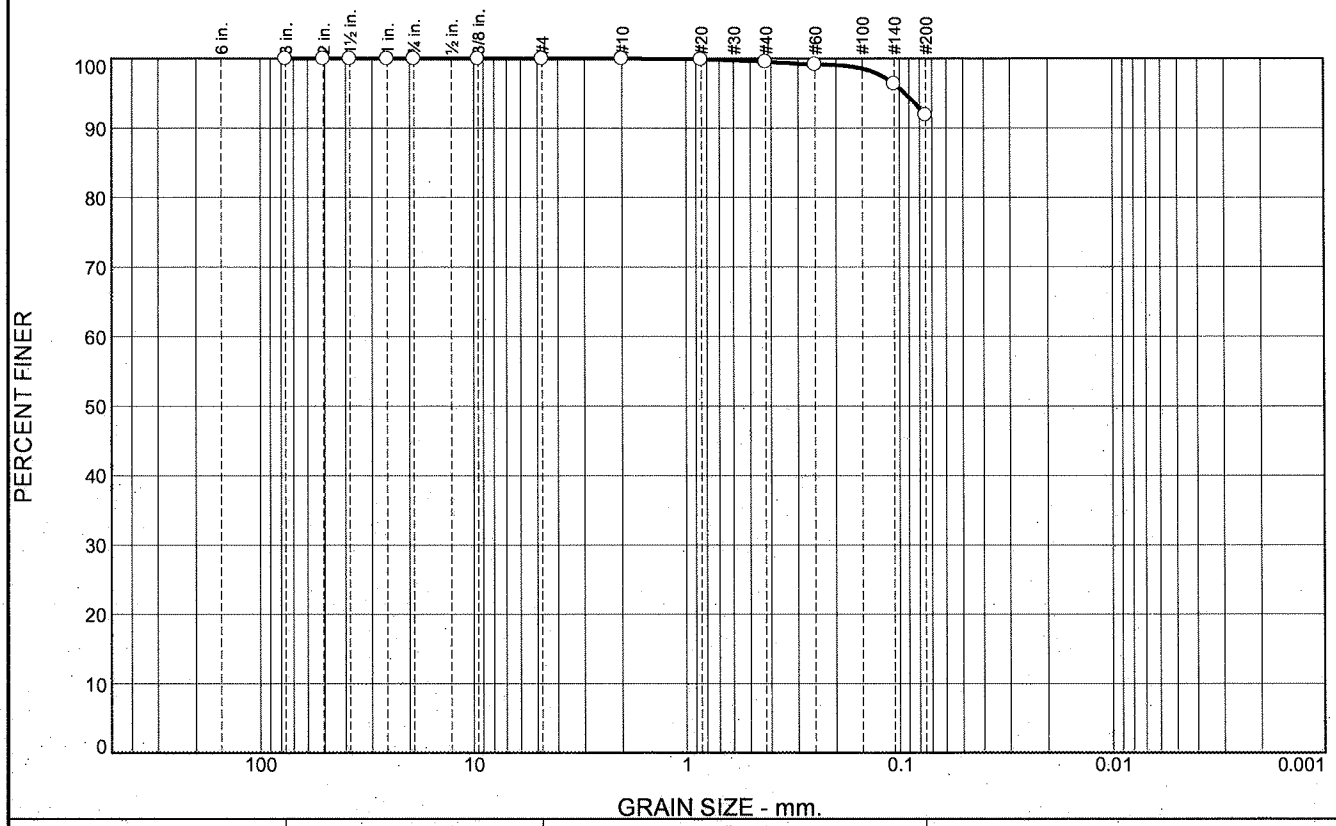
SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0	PAVEMENT		4" Asphalt, No Apparent Subbase	
						0.3	COASTAL PLAIN DEPOSITS			
0.5 - 2	S-1	X	4 - 5 - 9	6	14				Orangish-Brown Clayey Sand, Moist, Medium Dense (SC)	
2 - 4	S-2	X	4 - 4 - 4 - 5	NR	8	4.0			No Recovery, Presumed As Above, Loose (SC)	
4 - 6	S-3	X	3 - 5 - 6 - 7	10	11	5.0			Light Brown Silt, Moist, Soft (ML)	Qu = 0.5 tsf
6 - 8	S-4	X	3 - 5 - 5 - 7	14	10	6.0			Light Brown Elastic Silt, Moist, Medium Stiff (MH)	Qu = 1.5 tsf
8 - 10	S-5	X	6 - 8 - 7 - 8	9	15				As Above (MH)	Qu = 1.5 tsf
						10.0				
13 - 15	S-6	X	4 - 4 - 6 - 9	24	10				Light Brown Lean Clay, Moist, Medium Stiff (CL)	Qu = 1.25 tsf
						15.0				
18 - 20	S-7	X	4 - 7 - 8 - 7	21	15				As Above, Wet (CL)	Qu = 1.0 tsf
						20.0				
23 - 25	S-8	X	5 - 5 - 9 - 11	20	14				As Above (CL)	Qu = 1.0 tsf
						25.0			Boring Log B-6 Terminated at a Depth of 25.0 Feet Below Ground Surface	

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE

APPENDIX B
Laboratory Test Results

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.4	7.7	91.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	100.0		
#10	100.0		
#20	99.9		
#40	99.6		
#60	99.2		
#140	96.4		
#200	91.9		

* (no specification provided)

Material Description

Elastic Silt

Atterberg Limits

PL= 41 LL= 51 PI= 10

Coefficients

D_{90}= D_{85}= D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= MH AASHTO= A-5(15)

Remarks

W_n = 42.9 %

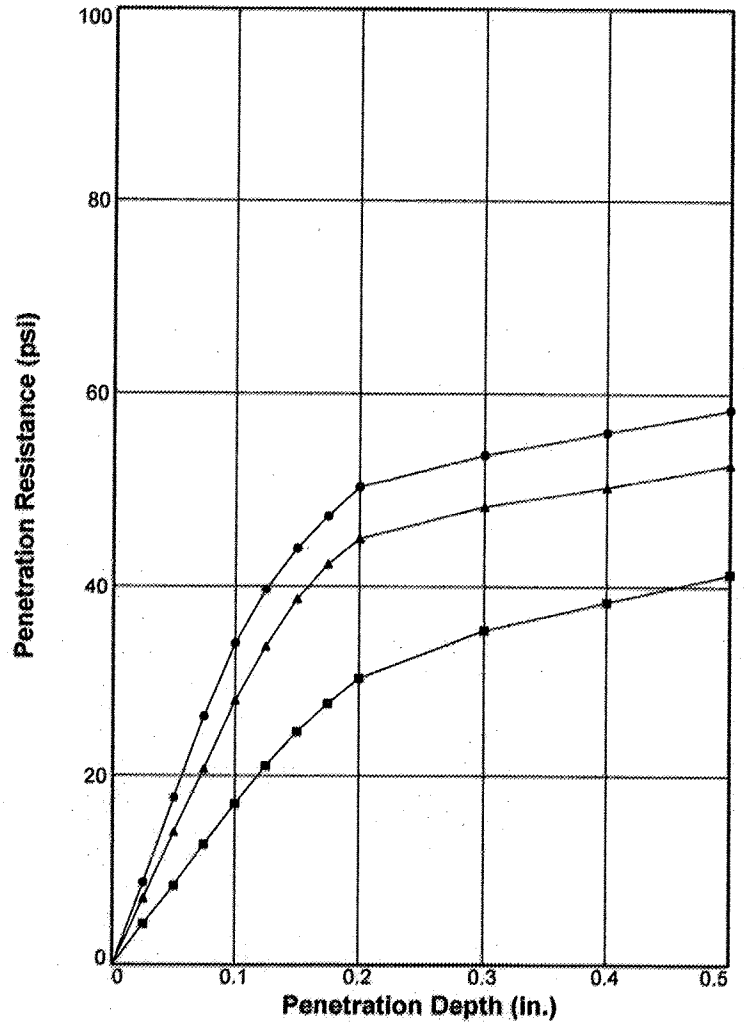
Source of Sample: B-6 **Depth:** 6.0' - 10.0'
Sample Number: S-4/S-5

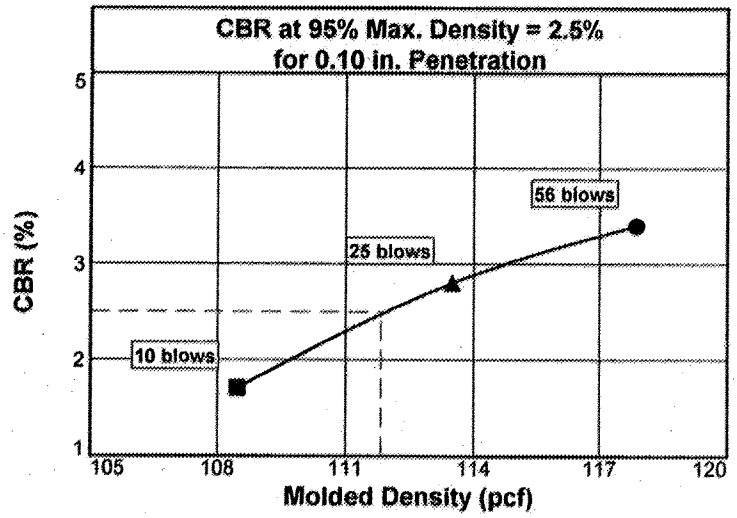
Date: 02/22/2023

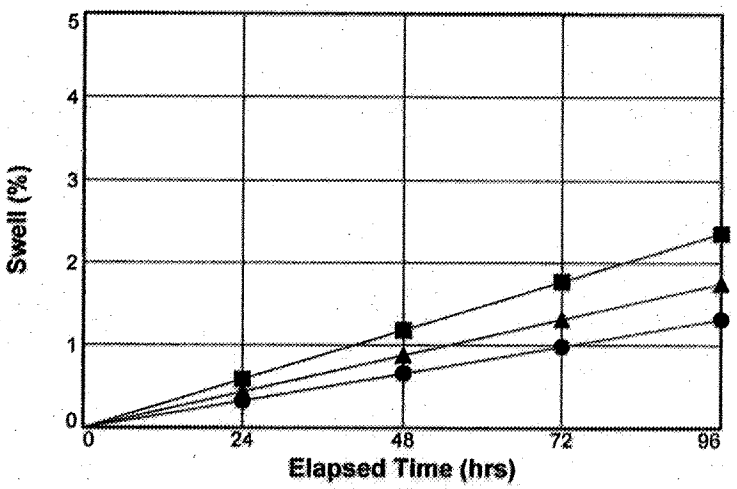
WHITESTONE ASSOCIATES, INC.
Warren, New Jersey

Client: ARH Associates
Project: Proposed Site Improvements
880 N.J.S.H. Route 45, Woodstown, Salem County, NJ
Project No: GS2319982.000 **Figure**

BEARING RATIO TEST REPORT
ASTM D 1883-07







	Molded			Soaked			CBR (%)		Linearity Correction (in.)	Surcharge (lbs.)	Max. Swell (%)
	Density (pcf)	Percent of Max. Dens.	Moisture (%)	Density (pcf)	Percent of Max. Dens.	Moisture (%)	0.10 in.	0.20 in.			
1 ○	117.9	100.2	13.4	116.3	98.8	20.1	3.4	3.4	0.000	10	1.3
2 △	113.5	96.4	13.4	111.5	94.8	23.0	2.8	3.0	0.000	10	1.7
3 □	108.5	92.2	13.4	106.0	90	25.8	1.7	2.0	0.000	10	2.4

Material Description	USCS	Max. Dens. (pcf)	Optimum Moisture (%)	LL	PI
Yellowish brown in color. sandy silt	ML	117.7	13.4	NV	NP

Project No: CKX-496

Project: GS2319982.000, Proposed Site Improvement, 880 Route 45, Woodstorm, Salem County, NJ

Location: Existing/New Pavement area

Sample Number: S-1

Date: 02/17/2023

Test Description/Remarks:

BEARING RATIO TEST REPORT

ANS CONSULTANTS, INC.

Figure 1 F 4

BEARING RATIO TESTING RESULTS
(ASTM D 1883-07)

Date: 02/17/2023
Project No.: CKX-496
Project: GS2319982.000, Proposed Site Improvement, 880 Route 45, Woodstorm, Salem Coun
Location: Existing/New Pavement area
Sample Number: S-1
Material Description: Yellowish brown in color. sandy silt
USCS Classification: ML
Liquid Limit: NV **Plasticity Index:** NP

Test Description:
Maximum Dry Density, pcf : 117.7 **Optimum Moisture Content, %:** 13.4
Testing Remarks:

Sample 1 (56 Blows, Surcharge: 10 lbs.)

Water Content

Wt. Wet Soil+Tare, gms.	Wt. Soil+Tare, gms.	Wt. Tare, gms.	Moisture, %
665.2	599.5	107.5	13.4

Unit Weight

Wt. Mold+Soil, lbs.	Wt. Mold, lbs.	Ht. Soil, in.	Density, pcf
27.7010	17.6885	4.58	117.9

Swell Data

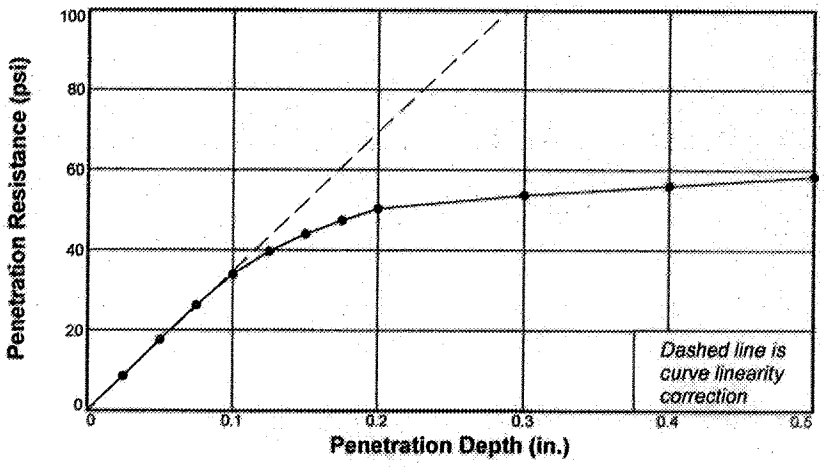
Elapsed Time, hrs.	Dial Reading in. x 1.000	Swell %
0	0	0.0
24	15	0.3
48	30	0.7
72	45	1.0
96	60	1.3

Final Water Content

	Wt. Wet Soil+Tare, gms.	Dry Soil+Tare	Tare	Moisture, %
1)	658.72	566.63	109.6	20.1

Penetration Test Data

Pen. in.	Dial Reading	Stress psi	CBR %
0.0	0	0.0	
0.025	8.67	8.7	
0.05	17.67	17.7	
0.075	26.33	26.3	
0.1	34.00	34.0	3.4
0.125	39.67	39.7	
0.15	44.00	44.0	
0.175	47.33	47.3	
0.2	50.33	50.3	3.4
0.3	53.67	53.7	
0.4	56.00	56.0	
0.5	58.33	58.3	



Sample 2 (25 Blows; Surcharge: 10 lbs.)

Water Content

Wt. Wet Soil+Tare, gms.	Wt. Soil+Tare, gms.	Wt. Tare, gms.	Moisture, %
665.2	599.5	107.5	13.4

Unit Weight

Wt. Mold+Soil, lbs.	Wt. Mold, lbs.	Ht. Soil, in.	Density, pcf
27.6205	17.9795	4.58	113.5

Swell Data

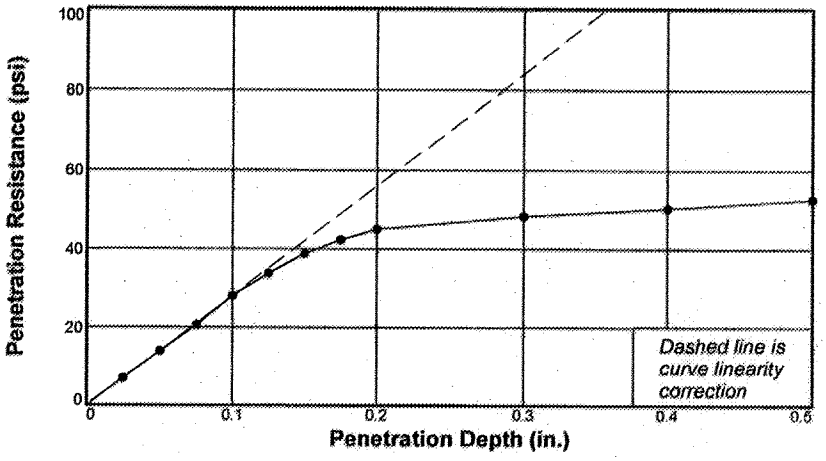
Elapsed Time, hrs.	Dial Reading in. x 1,000	Swell %
0	37	0.0
24	57	0.4
48	77	0.9
72	97	1.3
96	117	1.7

Final Water Content

	Wt. Wet Soil+Tare, gms.	Dry Soil+Tare	Tare	Moisture, %
1)	748.82	630.16	114.8	23.0

Penetration Test Data

Pen. in.	Dial Reading	Stress psi	CBR %
0.0	0	0.0	
0.025	7.00	7.0	
0.05	14.00	14.0	
0.075	20.67	20.7	
0.1	28.00	28.0	2.8
0.125	33.67	33.7	
0.15	38.67	38.7	
0.175	42.33	42.3	
0.2	45.00	45.0	3.0
0.3	48.33	48.3	
0.4	50.33	50.3	
0.5	52.67	52.7	



Sample 3 (10 Blows, Surcharge 10 lbs.)

Water Content

Wt. Wet Soil+Tare, gms. 665.2 | Wt. Soil+Tare, gms. 599.5 | Wt. Tare, gms. 107.5 | Moisture, % 13.4

Unit Weight

Wt. Mold+Soil, lbs. 25.2020 | Wt. Mold, lbs. 15.9880 | Ht. Soil, in. 4.58 | Density, pcf 108.5

Swell Data

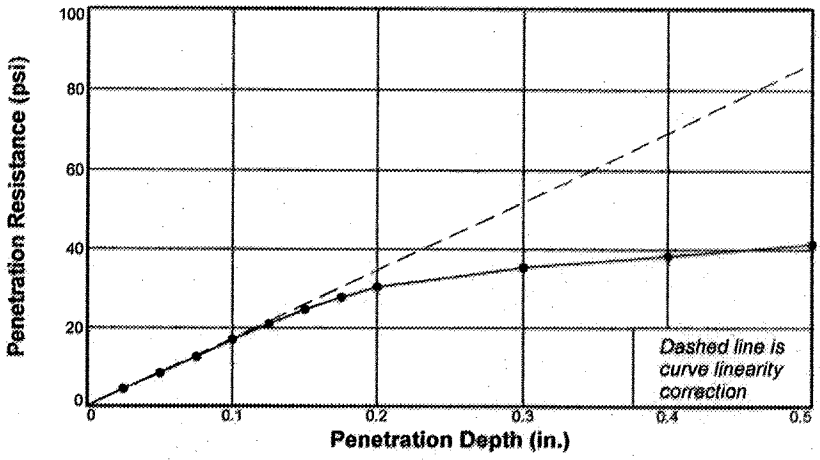
Elapsed Time, hrs.	Dial Reading in. x 1,000	Swell %
0	122	0.0
24	149	0.6
48	176	1.2
72	203	1.8
96	230	2.4

Final Water Content

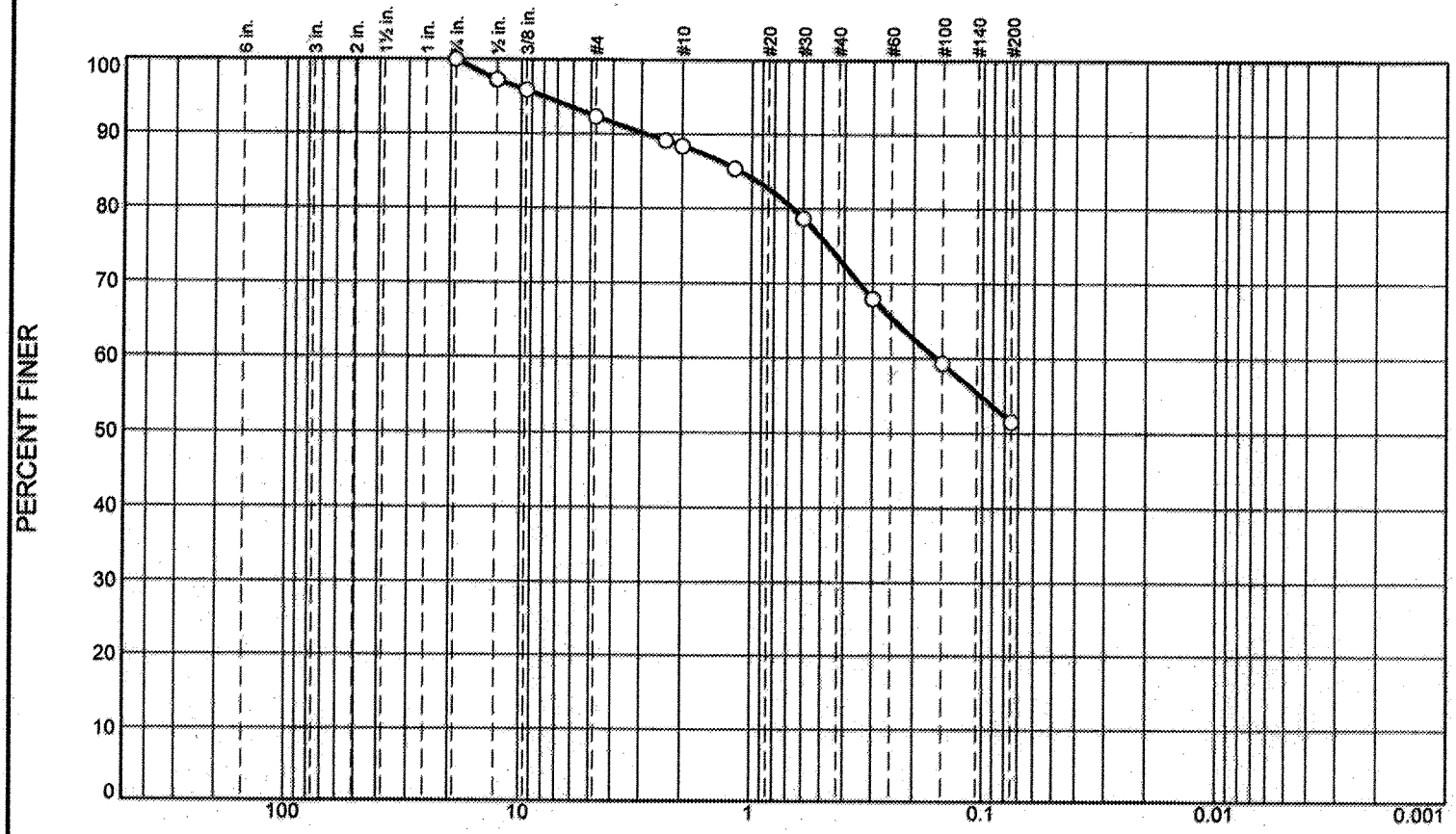
	Wt. Wet Soil+Tare, gms.	Dry Soil+Tare	Tare	Moisture, %
1)	533.22	445.97	107.5	25.8

Penetration Test Data

Pen. in.	Dial Reading	Stress psi	CBR %
0.0	0	0.0	
0.025	4.33	4.3	
0.05	8.33	8.3	
0.075	12.67	12.7	
0.1	17.00	17.0	1.7
0.125	21.00	21.0	
0.15	24.67	24.7	
0.175	27.67	27.7	
0.2	30.33	30.3	2.0
0.3	35.33	35.3	
0.4	38.33	38.3	
0.5	41.33	41.3	



Particle Size Distribution Report As per ASTM D-6913, D-7928



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	7.7	3.9	14.9	21.9	51.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4	100.0		
1/2	97.2		
3/8	95.8		
#4	92.3		
#8	89.1		
#10	88.4		
#16	85.4		
#30	78.7		
#50	68.0		
#100	59.3		
#200	51.6		

* (no specification provided)

Material Description

Yellowish brown in color, sandy silt

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 2.8944 D_{85}= 1.1228 D_{60}= 0.1600
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

Sample was dropped off by client on 02/10/23 and tested on 02/17/23. In-Situ %MC=20.5
F.M.=1.32

Location: Existing/New Pavement area
Sample Number: S-1

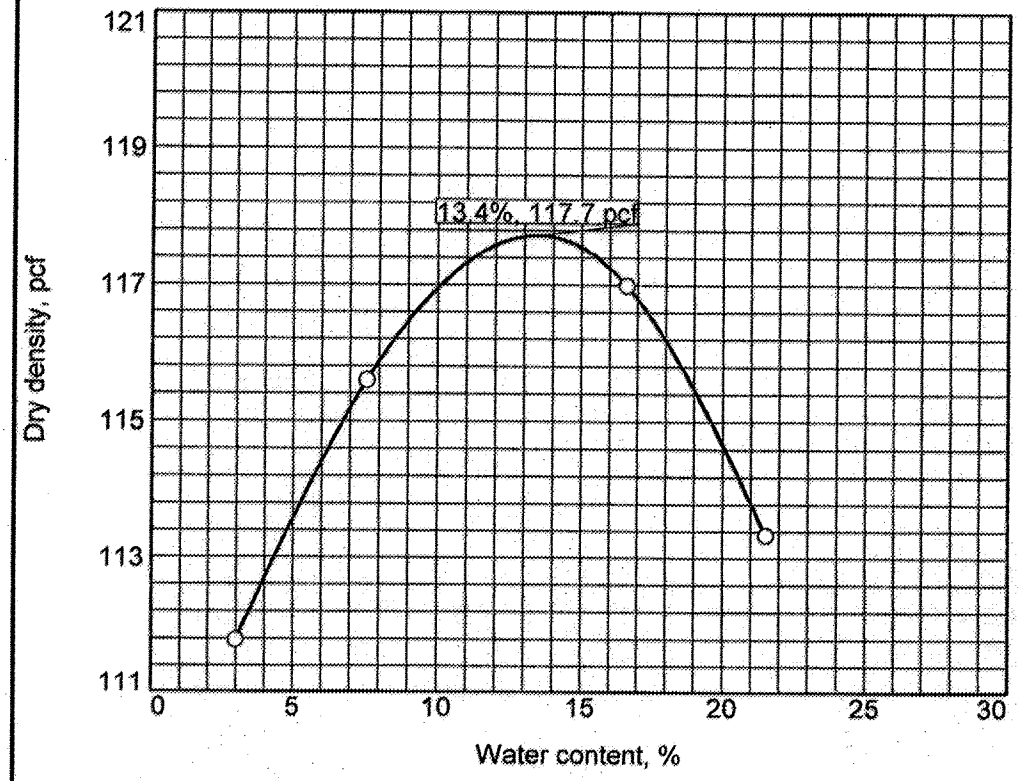
Date: 02/17/2023

ANS CONSULTANTS, INC.

South Plainfield, New Jersey

Client: Whitestone Associates, Inc.
Project: GS2319982.000, Proposed Site Improvement, 880 Route 45, Woodstorm, Salem County, NJ
Project No: CKX-496 **Figure 1 F 1**

COMPACTION TEST REPORT



Curve No.
S-1

Test Specification:
ASTM D 1557-12 Method C Modified

Preparation Method
Hammer Wt. 10 lb.
Hammer Drop 18 in.
Number of Layers five
Blows per Layer 56
Mold Size 0.075 cu. ft.
Test Performed on Material Passing 3/4 in. **Sieve**

NM **LL** NV **PI** NP
Sp.G. (ASTM D 854)
%>3/4 in. 0.0 **%<No.200** 51.6
USCS ML **AASHTO** A-4(0)
Date Sampled 02/17/2023
Date Tested
Tested By

TESTING DATA

	1	2	3	4	5	6
WM + WS	23.03	23.73	24.63	24.73		
WM	14.40	14.40	14.40	14.40		
WW + T #1	757.7	747.9	757.3	920.9		
WD + T #1	735.8	695.2	649.4	757.7		
TARE #1	0.0	0.0	0.0	0.0		
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	3.0	7.6	16.6	21.5		
DRY DENSITY	111.8	115.6	117.0	113.3		

TEST RESULTS

Maximum dry density = 117.7 pcf

Optimum moisture = 13.4 %

Project No. CKX-496 **Client:** Whitestone Associates, Inc.
Project: GS2319982.000, Proposed Site Improvement, 880 Route 45, Woodstorm, Salem County, NJ
○ **Location:** Existing/New Pavement area **Sample Number:** S-1

ANS CONSULTANTS, INC.

South Plainfield, New Jersey

Material Description

Yellowish brown in color, sandy silt

Remarks:
Sample was dropped off by client on 02/10/23 and tested on 02/13/23.

Checked by:
Title:

Figure 1 F 2

WHITESTONE

APPENDIX C
Pavement Condition Survey

WHITESTONE

PAVEMENT CONDITION SURVEY

Client: ARH Associates **Date:** 2/8/2023

Project: Proposed Site Improvements **File No.:** GS2319982.000

Location: 880 Route 45 **Field Engineer:** RL

Woodstown, Salem County, NJ

Grid Number	Distress Type	Distress Severity Level	Overall Condition Index
1	Potholes	High	Very Poor
	Alligator Cracking	High	
	Raveling	High	
2	Alligator Cracking	Medium	Very Poor
	Potholes/Patching	High	
	Raveling	Medium	
3	Longitudinal Cracking	Medium	Very Poor
	Alligator Cracking	High	
	Patching	High	
4	Longitudinal Cracking	Low	Fair
5	Potholes	Medium	Poor
	Alligator Cracking	Medium	
	Longitudinal Cracking	Low	
6	Longitudinal Cracking	Low	Fair
7	Longitudinal Cracking	Medium	Very Poor
	Potholes	High	
	Raveling	High	
8	Transverse Cracking	Low	Poor
	Alligator Cracking	Medium	
	Raveling	Medium	

WHITESTONE

PAVEMENT CONDITION SURVEY

Client: ARH Associates **Date:** 2/8/2023

Project: Proposed Site Improvements **File No.:** GS2319982.000

Location: 880 Route 45 **Field Engineer:** RL

Woodstown, Salem County, NJ

Grid Number	Distress Type	Distress Severity Level	Overall Condition Index
9	Alligator Cracking	Low	Fair
	Raveling	Low	
10	Potholes	High	Very Poor
	Longitudinal Cracking	Medium	
	Raveling	Medium	
11	Transverse Cracking	Medium	Poor
	Alligator Cracking	Low	
12	Longitudinal Cracking	Low	Poor
	Alligator Cracking	Medium	
	Potholes	Low	
13	Longitudinal Cracking	Low	Poor
	Alligator Cracking	Low	
	Potholes	Medium	
14	Potholes	High	Very Poor
	Alligator Cracking	Medium	
15	Alligator Cracking	High	Very Poor
	Raveling	High	
16	Longitudinal Cracking	Low	Poor
	Alligator Cracking	Medium	
	Raveling	Low	

WHITESTONE

APPENDIX D
Supplemental Information (USCS, Terms and Symbols)

WHITESTONE
An Employee-Owned Company

1959 HIGHWAY 34
BUILDING A, SUITE 102
WALL, NJ 07719
732.592.2101
whitestoneassoc.com

UNIFIED SOIL CLASSIFICATION SYSTEM

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
			GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SAND AND SANDY SOILS	CLEAN SAND (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
			SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMITS LESS THAN 50	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMITS GREATER THAN 50	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS			PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS FOR SAMPLES WITH 5% TO 12% FINES

GRADATION*

% FINER BY WEIGHT

TRACE..... 1% TO 10%
LITTLE..... 10% TO 20%
SOME..... 20% TO 35%
AND..... 35% TO 50%

COMPACTNESS*
Sand and/or Gravel

	RELATIVE DENSITY
LOOSE.	0% TO 40%
MEDIUM DENSE....	40% TO 70%
DENSE.....	70% TO 90%
VERY DENSE.....	90% TO 100%

CONSISTENCY*
Clay and/or Silt

RANGE OF SHEARING STRENGTH IN POUNDS PER SQUARE FOOT

VERY SOFT.....	LESS THAN 250
SOFT.....	250 TO 500
MEDIUM.....	500 TO 1000
STIFF.....	1000 TO 2000
VERY STIFF.....	2000 TO 4000
HARD.....	GREATER THAN 4000

** VALUES ARE FROM LABORATORY OR FIELD TEST DATA, WHERE APPLICABLE. WHEN NO TESTING WAS PERFORMED, VALUES ARE ESTIMATED.*

L:\Geotechnical Forms and References\Reports\USCSTRMSSYM NJ-Wall.docx

WHITESTONE
An Employee-Owned Company

1959 HIGHWAY 34
BUILDING A, SUITE 102
WALL, NJ 07719
732.592.2101
whitestoneassoc.com

GEOTECHNICAL TERMS AND SYMBOLS

SAMPLE IDENTIFICATION

The Unified Soil Classification System is used to identify the soil unless otherwise noted.

SOIL PROPERTY SYMBOLS

N: Standard Penetration Value: Blows per ft. of a 140 lb. hammer falling 30" on a 2" O.D. split-spoon.
Qu: Unconfined compressive strength, TSF.
Qp: Penetrometer value, unconfined compressive strength, TSF.
Mc: Moisture content, %.
LL: Liquid limit, %.
PI: Plasticity index, %.
δd: Natural dry density, PCF.
▼: Apparent groundwater level at time noted after completion of boring.

DRILLING AND SAMPLING SYMBOLS

NE: Not Encountered (Groundwater was not encountered).
SS: Split-Spoon - 1 ⅜" I.D., 2" O.D., except where noted.
ST: Shelby Tube - 3" O.D., except where noted.
AU: Auger Sample.
OB: Diamond Bit.
CB: Carbide Bit
WS: Washed Sample.

RELATIVE DENSITY AND CONSISTENCY CLASSIFICATION

Term (Non-Cohesive Soils)	Standard Penetration Resistance
Very Loose	0-4
Loose	4-10
Medium Dense	10-30
Dense	30-50
Very Dense	Over 50

Term (Cohesive Soils)	Qu (TSF)
Very Soft	0 - 0.25
Soft	0.25 - 0.50
Firm (Medium)	0.50 - 1.00
Stiff	1.00 - 2.00
Very Stiff	2.00 - 4.00
Hard	4.00+

PARTICLE SIZE

Boulders	8 in.+	Coarse Sand	5mm-0.6mm	Silt	0.074mm-0.005mm
Cobbles	8 in.-3 in.	Medium Sand	0.6mm-0.2mm	Clay	-0.005mm
Gravel	3 in.-5mm	Fine Sand	0.2mm-0.074mm		

DIVISION 1 - SITE WORK

INDEX

TECHNICAL SPECIFICATIONS

This contract is based on the following technical specifications. In addition, said Contractor shall adhere to the 2019 Edition of the NJDOT Standard Specifications for Road and Bridge Construction for any clarifications or discrepancies. It is understood and agreed that any definitions, article, clause, direction, meaning or intention, omitted or being under discussion, the interpretation shall be referred to the said current Standard Specifications for Road and Bridge Construction of the State of New Jersey Department of Transportation, as amended herein, the interpretation shall be the same as if the said Standard Specifications were totally included at length in these Specifications.

The Contractor is responsible for obtaining and having a copy of the Standard Specifications for Road and Bridge Construction, 2019 and applicable revisions. The Contractor shall also be responsible for obtaining and having a copy of the Standard Roadway – Traffic Control – Bridge Construction Details Booklet, 2016 and applicable revisions.

Successful bidder shall also apply for and obtain local building permits for all construction and installation.

The successful bidder is notified that the entire project will be bid as one lump sum project and quantities have not been provided.

PLANS FOR BIDDING:

THE SUCCESSFUL BIDDER UNDERSTANDS THAT THE ATTACHED PLANS ARE FOR BIDDING PURPOSES ONLY, AND THAT THE OWNER WILL PROVIDE CONTRACTOR WITH REVISED PLANS REFLECTING RFI ISSUES, ADDENDA MODS, AND SLIGHT CHANGES TO GRADING, ALIGNMENTS AND DIMENSIONS OF SPECIFIC IMPROVEMENTS.

-- END OF SITE WORK DIVISION 1 INDEX --

DIVISION 1

This contract is based on the following technical specifications. In addition, said Contractor shall adhere to the 2019 Edition of the NJDOT Standard Specifications for Road and Bridge Construction for any clarifications or discrepancies.

List of Required Submittals:

1) ***Mix formulas for:***
   a. ***HMA Base Course, 19M64***
   b. ***HMA Surface Course, 9.5M64***
2) ***¾" Clean Stone, Dense Graded Aggregate, and Riprap (D_{50}=4")***
3) ***Tack Coat***
4) ***HMA Releasing Agent***
5) ***DeTack***
6) ***Select Fill***
7) ***Concrete Washout Station***
8) ***Traffic Paint***
9) ***Seeding, Fertilizer& Topsoil Mix***

1.01 SITE PREPARATION AND CLEARING

1.01.01 Scope of Work

The Contractor shall furnish and deliver all material, labor, equipment, supervision and all else necessary and incidental to performing all specified and unspecified construction for site preparation, clearing and grubbing to include the following:

(a) Mobilization, bonds, insurance, porta-pot set-up, etc., all incidentals for this job should be included in the lump sum bid price for Site Preparation and Clearing.

(b) Clearing, grubbing, removal and disposal of trees for which payment is not otherwise provided in the Contract, shrubs, bushes, weeds, roots and similar vegetative materials, whether standing or felled.

(c) Removal and disposal of structures or other obstructions above existing ground level either standing or felled which are designated for removal on the plans or directed by the Engineer during construction and for which payment is not otherwise provided in the Contract.

(d) Remove and trim any limbs or branches hanging over into the road that is in direct conflict with the milling machine and paving crew, including the triaxle when the dump is in up position.

Any removal of limbs, grubbing activities, or tree remains shall be the responsibility of the Contractor to dispose of properly.

(e) Contractor shall make all reasonable efforts to protect landscaping and hardscaping items that are not in conflict with milling and paving operations.

(f) Saw-cutting, removal and disposal of all bituminous and concrete materials, whether specified or unspecified on the plans, required for the completion of the work and for which payment is not otherwise provided in the Contract.

(g) Removal, temporary storage or resetting if required, and final resetting of mailboxes, signs, pole borders, timber ties, fences, guard rails, bus shelters, hedges, trees or shrubs whether specified or unspecified on the plans or as directed by the Engineer.

Bidder must visit site and note all hardscaping and other items that should be relocated during the milling, paving and trench reconstruction.

Under this item the Contractor shall include all costs associated with mobilization and demobilization.

1.01.02 Materials

Materials shall conform with Section 201.02 of the NJDOT Standard Specifications for Road and Bridge Construction, 2019, or as amended. Miscellaneous Materials: At Contractor's option subject to the approval of the Engineer. Any and all traffic control devices, including but not limited to cones, signs, barricades etc., shall be in accordance with Traffic Control Standards.

1.01.03 Methods of Construction

All Site Preparation, Clearing and Grubbing methods shall conform to Section 201 of the NJDOT Standard Specifications for Road and Bridge Construction, 2019, or as amended. In addition, the Contractor shall do the following:

(a) Clear the project site within the limits of construction shown on the plans, or as directed by the Engineer. It is the intention of the plans to clear only those portions of the site that are absolutely necessary and essential for construction.

(b) Repair all injuries to bark, trunk, limbs and roots or remaining plants by properly dressing, cutting, tracing, and painting using approved tree surgery methods, tools and equipment.

(c) Clear designated areas of brush, weeds, trees, roots, debris and other unsuitable material.

(d) Dispose of accumulated waste materials in accordance with applicable State regulations.

(e) Rough grade all grubbed and cleared areas and provide temporary stabilization as required per soil erosion and sediment control plan.

Protection: Roads, structures, pavement areas, grass or landscaping to remain shall be protected by Contractor in a manner approved by the Engineer.

(a) Whenever possible, excavation shall include the removal and storage of topsoil from the site for future use. The length of time of ground disturbance shall be reduced to the minimum practicable, especially in environmentally critical areas. Ground disturbances shall be avoided until immediately preceding construction to minimize exposure of soils. In all cases the Contractor shall conform to SCS Standards for temporary soil erosion and sediment control.

(b) Signs, fences, guiderails and other obstructions that are to be temporarily removed or reset shall be properly stored and protected until they are permanently reset. The Contractor shall exercise care in the removal, storage and resetting of the structures. Any damage to the materials or structures as a result of the Contractor's carelessness shall be repaired or replaced by the Contractor at no additional expense to the Owner.

(c) Existing underground utilities and above ground utility poles which may be encountered shall be secured and protected from damage by the Contractor, during construction. The cost for protection, relocation or resetting shall be included in the lump sum price for this item – Site Preparation and Clearing.

The Contractor shall assure that all discharges from dewatering activities to surface waters, wetlands or storm sewers shall be free of sediment. The Contractor shall use reasonable care to assure that no damage is done to vegetation by excessive watering or by damaging silt accumulation in the discharge area.

(a) The Contractor shall use methods such as sedimentation basins, hay bales, silt fences, stone filters, etc., to achieve the desired result.

The Contractor shall be required to sawcut, removal and disposal of all bituminous and concrete materials as designated on the plans or directed by the Engineer, required for the completion of the work and for which payment is not otherwise provided in the Contract.

All HMA and concrete features to be repaired or extended must be sawcut prior to removing material for repairs. There is no specific payment or measurement of saw-cutting and cost thereof should be included in various other items in the proposal.

1.01.04 Method of Measurement and Payment

Cost for Site Preparation and Clearing shall be included in the Lump Sum Bid Price for the project.

Also, the cost for site mobilization, insurance, bonds, porta-pot, final clean-up and demobilization shall be included in the Lump Sum Bid Price for the project.

1.02 NO ITEM

1.03 SITE EXCAVATION & GRADING

1.03.01 Scope of Work

Under this item, the Contractor will complete excavation for the construction of full depth pavement repair, concrete pad, and any location as indicated on the plans and as specified herein or directed by the Engineer.

Included in the work of this item shall be the stripping, stockpiling of all suitable, salvageable topsoil for reuse as fill material. Suitable and salvageable shall be free of debris and have no stones greater than one-half (1/2") inch. All excess clean material shall become the property of the Contractor and shall be removed, transported, and properly disposed of in accordance with all applicable laws.

This item includes excavation of any and all materials for test pits required for sanitary sewer installation. Pits will typically be 12-inches wide by a variable depth by 3-feet long, either by a small excavator or by hand. A typical test pit will be approximately 12 cubic feet. Contractor shall be responsible to place a "One Call" ticket prior to completing any excavation activities.

1.03.02 Material & Classification

The materials &/or classification shall conform to Section 202 of the NJDOT Standard Specifications for Road and Bridge Construction, 2019, as amended therein. Select fill may be clean gravel material meeting Soil Aggregate Designation I-9 or I-11, or better; said select fill may also be recycled crushed concrete, placed in 12-inch lifts, loose measure, and compacted to 95-percent of its maximum dry density. Millings may be used for sub-base reconstruction activities; however, millings cannot be used for filling in under-cut areas.

1.03.03 Methods of Construction

The Contractor shall excavate within the limits shown on the plans, as specified herein, or as directed by the Engineer. Prior to field excavation, the Contractor and Engineer shall mark the limits of the excavation area. The intent of this project is to excavate existing material to the depth needed to obtain the section shown in the details of the plan set. The Contractor shall also verify that all soil erosion and sediment control measures are in place.

The Contractor shall perform all field excavation to remove existing material. No additional excavation depth shall be completed unless previously directed by the Engineer. The Contractor shall be required to strip and stockpile all suitable topsoil for reuse on the site. Any stockpiles of excavated material shall have silt fence at the toe surrounding the piles. Material is to be segregated and protected during construction to ensure no intermixing occurs with substrate materials. All remaining excess suitable material shall be the property of the Contractor and shall be removed, transported, and disposed of in accordance with all applicable laws.

Salvaged topsoil shall be thoroughly tamped to 95% of its maximum proctor density. After installation of salvaged topsoil, the Contractor will be required to provide the Engineer an as-built of the project area. This as-built will be used to confirm the elevations are in conformance with the approved plans. The Engineer shall review the as-built to ensure the elevations have been achieved in all areas. If the Engineer determines the elevations have not been achieved, the

Contractor will be required address any inadequate areas and then provide a revised as-built for the Engineer to review and approve.

The Engineer shall be notified 48 hours prior to initiating topsoil and final grading operations.

If required by any utility company, provide the required advance notice before beginning the work within the vicinity of the utility. If utilities need to be supported or protected, submit a plan to the Utility for approval that includes the method of support or protection to provide for uninterrupted service. At least 20 days before beginning the work, provide a copy of the plan and the Utility's approval to the RE. Protect and support utilities according to the approved plan.

Protect and support existing electrical and ITS facilities and ensure that there is no interruption of service. Use hand tools only while working within two feet of the fiber optic network. At least 30 days before beginning the work, submit a plan to the RE for approval showing the method of support and protection.

If any utilities are disrupted due to excavation, the Contractor shall stop work immediately, contact the Engineer, and be responsible for contacting the corresponding utility company. Any repairs or fees assessed by the utility company shall be the responsibility of the Contractor.

Excavated material shall be replaced in the test pit in 12-inch lifts, compacting each individual lift before proceeding to the next.

At no cost to Owner, the Contractor will be responsible for restoring all excavated areas prior to the end of the workday so that they are flush with the road and are structurally stable, with no settlement. For an overnight restoration, Contractor may place base course or recycled asphalt, compacted thickness of 6-inches, minimum. The Contractor will be required to make sure the excavated areas are compacted properly and do not affect the rideability of the road.

There is no specific payment to create safe road surfaces at the end of each workday and the cost thereof should be included in various other items in the proposal.

1.03.04 Method of Measurement and Payment

The cost for site work and test pit excavation, including any surveying, developing details, backfilling, etc, shall be included in the Lump Sum Bid Price for the project.

1.04 CONSTRUCTION LAYOUT

1.04.01 Scope of Work

Under the Construction Layout item, the Contractor shall furnish and deliver all materials, equipment, labor, supervision and all else necessary and incidental for the surveying areas of concern for proper drainage. These areas shall be indicated on the plans, specified herein, or as directed by the Engineer.

1.04.02 Methods of Construction

Construction Layout:

The Contractor will procure the services of a licensed surveyor to survey, grade stake, and provide a cut sheet for any areas, as directed by the engineer, where there are currently known drainage concerns. The surveyor shall provide cut and fill amounts for the left and right curb lines as well as the crown. All cut and fill amounts shall be shown either by a mark out on the street or on grade stakes. The surveyor shall provide the Engineer with a proposed cut and fill sheet a minimum of 48 hours prior to any milling of area in question.

The licensed surveyor should also be prepared to survey and grade stake and provide cut sheets for up to two locations, 500-ft each, where the pavement or curb needs to be modified to improve grading. Said cut sheets would be prepared and given to the Engineer for review and concurrence within 48-hours after preparation, so as not to delay the concrete crew.

1.04.03 Method of Measurement and Payment

The cost for Construction Layout for which payment shall be made shall be included in the Lump Sum Bid Price for the project.

1.05 MILLING, VARIABLE DEPTH

1.05.01 Scope of Work

Under this item, the Contractor shall furnish and deliver all materials, equipment, labor, supervision and all else necessary and incidental for the variable depth milling of the existing roadway in locations as indicated on the plans, specified herein, or as directed by the Engineer.

In some instances, the milling machine may mill down to aggregate, in order to then undercut for removal and replacement of unsuitable sub-grade.

Owner will authorize deeper cuts in the field prior to milling crew mobilizing on said roadway.

At inlets, mill around frames to allow for a minimum of 2-inches of HMA placement.

At limits of work, mill a key-joint, 2-inches deep, square and vertical. In some instances, a 3-inch deep key-joint may be necessary.

All milling is considered 'variable depth,' and Owner will direct the superintendent in the field what depth of milling shall be used at specific areas of the road.

1.05.02 Materials

The materials shall conform to Section 202 of the NJDOT Standard Specifications for Road and Bridge Construction, 2019, or as amended.

1.05.03 Methods of Construction

Construction for this item shall comply with section 401.03.01 of the NJDOT Standard Specifications for Road and Bridge Construction, 2019, or as amended.

HAULING AWAY OF UNSUITABLE SOILS AND MILLINGS:

All millings shall become the Contractor's property and will be the Contractor's responsibility to properly remove and dispose of the material in accordance with local and state regulations.

1.05.04 Method of Measurement and Payment

The cost for the item Milling, Variable Depth (as specified above) for which payment will be made shall be included in the Lump Sum Bid Price for the project.

Payment shall include, but not necessarily be limited to, the cost of providing all materials, saw cutting, milling, scarification, pulverization, excavation, disposal of excess material, redistribution, rough and fine grading, compaction, compaction testing and all else as above described, including all labor, equipment, supervision and all else necessary therefore and incidental thereto for a complete and satisfactory installation.

1.06 HOT MIX ASPHALT COURSES

1.06.01 Scope of Work

Under this Section, the Contractor shall furnish, deliver and install all materials, equipment, labor, supervision, and all else necessary and incidental to install the specified thickness of Hot Mix Asphalt (HMA), Surface and Base Courses within roadways, drive aisles, and parking areas indicated on the plans, as specified herein, or as directed by the Engineer.

Rideability:

Owner requires the Contractor to level any undulating areas of each area, at the direction of the Engineer, prior to surface course paving with HMA 9.5M64 material. Therefore, the finished road surface shall be smooth longitudinally, with no 'wash-boarding' affect from faulty or improper paving and rolling operations.

If any surface appears to 'wash-board,' the Owner will require the Contractor to perform the 'rolling-straight-edge test' in accordance with the NJDOT Standard Specifications, Section 400 of the 2019 Book.

If any portion of said road fails the straight-edge test, then repairs will be required by the Contractor at no cost to the Owner.

At the terminus of the project, inspect and mark out the limit of milling and paving at both ends. Do not change the gutter line unless directed by the Engineer.

CRCG shall be prohibited in the top layer of HMA Surface Course. LIMESTONE ROCK MATERIAL IS HEREBY PROHIBITED FROM THE HMA MIX DESIGN.

Included in this item shall be all surface preparation and cleaning of existing surfaces, saw cutting and tack coat as may be required per NJDOT Standard Specifications specified herein.

All areas shall be tack-coated before topping.

The quality of materials and performance of the work specified in this section shall be in accordance with Section 401 of the NJDOT Standard Specifications for Road and Bridge Construction, 2019, or as amended.

1.06.02 Materials

All material, labor, equipment and supervision shall be furnished by the Contractor.

(a) Provide HMA 19M64 Base Course
(b) Provide HMA 9.5M64 Surface Course

Standard Duty Full Depth Pavement:

Areas of Standard Duty Full Depth Pavement, as indicated on the plans, shall consist of 2" HMA 9.5M64 Surface Course and 3" HMA 19M64 Base Course over 6" Compacted DGA.

Owner Testing:

Owner will take random tests of HMA materials as required if areas are suspect. Penalties for each lot of material may be assessed in accordance with the state specifications if a full 10,000 square yard lot does not comply with the State Book.

Testing will be limited to cores for thickness, air voids and composition.

Equipment shall be in accordance with 401.02.02 of the NJDOT Standard Specifications.

Submittals:

(a) Contractor shall submit to the Engineer for approval two (2) copies of the job mix formulas or mix designs.
(b) Lack of the above requested submittal data is cause for rejection.

1.06.03 Methods of Construction

The construction standards of Section 401 of the NJDOT Standard Specifications for Road and Bridge Construction, 2019, or as amended shall apply.

(a) Contractor shall notify all utility companies prior to construction. Prior to any excavation, the Contractor will thoroughly familiarize himself with those areas that are to be excavated as indicated on the plans and at the direction of the Engineer. If there are any questions as to any changes in those areas, they shall only be changed by requesting such changes and receiving approval of the Engineer as called for in the specifications.

It will be the Contractor's responsibility to raise or lower any and all manhole frames and covers, inlet grates and valve boxes to grade and replace them if they are damaged during excavation. The areas shall be excavated to the depth necessary to provide the previously determined contour or cross-section of the street. This excavated material shall be completely disposed of by the Contractor, hauled at the Contractor's expense to be disposed of in compliance with applicable State, County or Local regulations.

(b) Milling shall only be done if the paving crew is mobilized and ready to start paving immediately the next day; failure to comply will result in a shut-down of the project until specification may be attained by the Contractor.

(c) The subbase shall be properly shaped and graded in order to receive the stabilized base course. The sub grade shall not be prepared when it is unstable because of excessive moisture. The sub grade shall be shaped and compacted, and when finished, it shall conform to the required sub grade and contour. The sub grade shall be shaped and smoothed to correct ridges and other surface irregularities caused by the compaction equipment or otherwise and shall be well compacted by smooth steel 3-wheel power rollers, weighing not less than 330 pounds per linear inch of tread of the rear wheels.

Prior to approval of this item, the subbase must be proof rolled in the presence of the Engineer and/or the Engineer's representative. Proof roll sub grade surfaces using heavy, rubber-tired rollers or loaded dump trucks. Check sub grade for areas requiring additional compaction. Unsuitable material shall be removed and replaced with DGA at the direction of the Engineer and proof rolled again, until accepted. DGA shall be paid for under the Select Fill pay item. Do not begin paving work until such conditions have been corrected and are ready to receive paving.

Determination of Theoretical Weight: Before construction of surface courses, the theoretical weight per square yard per inch of thickness shall be determined for each type of surface course specified.

(d) If the time period between installation of the stabilized base course and the laying of the surface course is in excess of three (3) days or in the opinion of the Engineer is excessive whereby settlement or other irregularities with the surface occur prior to surface course installation, then the Contractor shall mill and/or add additional material and compact as hereinbefore specified. Any such additional material shall be supplied at the Contractor's expense.

(e) The paving machine shall be equipped with a heated, vibrating screen in proper working condition, free of any particles or dried on aggregate or asphalt cement.

(f) Two (2) vibratory rollers of at least twenty (20) tons and ten (10) tons, shall be on the job at all times and shall be operated by a competent, experienced operator. A five (5) finish roller must be in operation at all times, not operated by the breakdown roller operator. No roller speed shall exceed 5-miles per hour at any given instance.

Weather Limitations

(a) HMA mixtures shall only be placed when the combinations of lay down and base surface temperatures are within the limits shown in Table 401.03.03 of the NJDOT Standard Specifications, when it is not raining and when the subbase is in satisfactory condition.

(b) For other than surface courses, in case of sudden rain, the placing of mixture then in transit from the plant may be permitted, if laid at proper temperature and if the base is free of pools of water. Such permission shall in no way waive any of the requirements of the specifications.

(c) Lay down temperature will be measured in the receiving hopper of the paver.

Barricades and Watchmen

(a) Barricades and watchmen shall be provided by the Contractor to keep traffic from the newly laid surface until properly compacted and rolled for at least 2 hours.

(b) Traffic shall be carried, if absolutely necessary, on the completed base course for the minimum time required to maintain traffic, the Contractor shall be responsible for the maintenance of the base course at all times while it is available to traffic.

1.06.04 Method of Measurement and Payment

For all items in this section prices shall include, but not necessarily be limited to, the cost of providing all materials as above described, cost of all excavation, surface preparation, saw cutting, prime and tack coats, placing and rolling of HMA material, including all labor, equipment, supervision and all else necessary therefore and incidental thereto for a complete and satisfactory installation.

Payment for HMA Surface and Base Course items shall be included in the Lump Sum Bid Price for the project.

1.07 STONE

1.07.01 Scope of Work

This section shall pertain to the following materials to be used under this contract:

a) ¾" Clean Stone
b) Dense Graded Aggregate (DGA)
c) Riprap (D_{50}=4") Channel Protection

The Contractor shall include materials, labor, equipment, supervision, and all else necessary and incidental to performing under the specifications contained herein.

DGA shall be placed 6-inches thick for standard duty pavement repair to construct a stable sub-base in accordance with the plans, as specified herein, or as directed by the Engineer. Sub-base aggregates may be millings or recycled crushed concrete.

1.07.02 Materials

Stone materials shall be in accordance with Section 901 the NJDOT Standard Specifications for Road and Bridge Construction, 2019, or as amended.

Submittal Requirement: The Contractor shall provide submittals for the stone materials to be supplied, illustrating conformance to the NJDOT Standard Specifications. The submittal must be approved by the Engineer prior to using any imported stone materials.

1.07.03 Methods of Construction

The Contractor shall furnish, deliver and install imported aggregate materials to augment existing material on site.

Stockpile aggregate materials in sufficient quantities in designated areas on the site to meet the project schedule and requirements.

Separate differing materials with dividers or stockpile apart to prevent intermixing or contamination.

Direct surface water away from stockpiles to prevent erosion or deterioration of materials.

Install materials at those locations and to those thicknesses as indicated on the plans, specified herein, or as directed by the Engineer.

Material shall be evenly distributed and compacted in 6"-12" lifts.

A. ¾" Clean Stone

The Contractor shall place the ¾" stone uniformly to the limits and depth as indicated on the plans, specified herein, or as directed by the Engineer. Once placed, the material shall be shaped and compacted to the typical cross sections as noted. The Contractor shall allow for

losses, shrinkage and compaction in the unit price bid.

The Contractor shall take care during the placement of the ¾" stone, not to allow foreign materials to become intermingled with the stone. The ¾" stone must remain clean. The Contractor will be required to remove any stone that is not clean.

B. DGA

The Contractor shall place the dense graded aggregate, 6-inches thick, within the designated areas on the plans or as directed by the Engineer in said areas once the excavation & grading operation has been completed.

DGA used as sub-base may be millings or recycled crushed concrete.

Once placed, the material shall be shaped and rolled to the typical cross sections as noted and rolled to the satisfactory compaction as stipulated in the NJDOT Standard Specifications for Road and Bridge Construction, 2019, or as amended. The Contractor shall allow for losses, shrinkage and compaction in the unit price bid.

C. Riprap (D_{50}=4") Channel Protection

The Contractor shall complete all work necessary, and incidental in order to prepare for the installation of Riprap materials. The Contractor shall excavate and reshape the area indicated on the plans, these specifications, or as directed by the Engineer. Any and all dewatering required to complete the installation shall be included in this bid item. Immediately before the construction of the 6" thick channel protection, the surface shall be trimmed and thoroughly compacted by mechanical or vibrating tampers.

The installation of the channel protection shall be in accordance with Section 603.03 of the Standard Specifications for Road and Bridge Construction, 2019 or as amended.

1.07.04 Method of Measurement and Payment

The quantity of ¾" Clean Stone, Dense Graded Aggregate, and Riprap (D50=4") Channel Protection for which payment will be made shall include all aggregate materials supplied/distributed/constructed within the limits of disturbance and any stone required under structures, as required in accordance with the plans, or as directed by the Engineer.

The Contractor must provide certified slips for all aggregate materials delivered to the job site. The cost shall include all materials, storage, labor, equipment, etc. necessary therefore or incidental thereto and shall be included in the Lump Sum Bid Price for the project.

1.08 BITUMINOUS MATERIAL DISTRIBUTION

1.08.01 Scope of Work

Under this item, the Contractor shall furnish all material, equipment, labor, supervision and all else necessary to apply tack coat to a cleaned and prepared road surface in accordance with Section 401.03.02 of the NJDOT Standard Specifications for Road and Bridge Construction, 2019 or as amended.

DeTack shall be furnished and applied after the joint sealer to prevent sealer spreading onto the new HMA surface matt.

Asphalt Releasing Agent shall be furnished and applied as needed to tools, machinery, truck beds, boots, etc.

1.08.02 Materials

Contractor shall use SS-1 tack coat for all areas within the roadway. Tack coat shall be applied in accordance with Section 401.03.02 of the NJDOT Standard Specifications for Road and Bridge Construction, 2019 or as amended.

Pure emulsion water-based tack is prohibited.

DeTack, manufactured by Crafco, or approved equal. Must be approved by the NJDOT Standards.

Asphalt Releasing Agent shall be used to release any asphalt from tools, equipment, truck beds, boots, etc., no exceptions. Asphalt Releasing Agent must be approved by the NJDOT standards.

1.08.03 Methods of Construction

Apply to cleaned surfaces of all pavements to be overlaid. Failure to sweep entire road free from debris, sand, and dust may result in rejection of pavement placement.

Apply to cleaned surfaces of newly constructed base pavement if coasted with dust, dirt, foreign materials in sufficient amount to create bond with surface course paving as determined by Engineer.

Apply to edges of paving where base repairs are to be made.

Apply tack coat material at temperatures, and observe safety precautions, specified in Section 401.03.02 of the NJDOT Standard Specifications for Road and Bridge Construction, or as amended. Pure emulsion water-based tack is prohibited.

Apply at rate of 0.10 gallon per square yard as directed by Engineer, immediately prior to placing pavement.

Apply tack coat by spray or brush to contact surfaces of pavement cold joints, curbs, gutters, manholes, and other structures protecting into or abutting asphalt concrete pavement.

Allow surfaces to dry until material is in a condition of tackiness to receive pavement.

Take precautions to ensure tack coat is not applied to exposed surfaces or curbs or other exposed surfaces. Contractor shall remove tack coat so applied at no additional cost to Owner.

Tack machine must be fully operational, with no clogged jets.

Contractor shall provide Engineer or Engineer's Representative with the calibration and start quantity on the tack coat sprayers prior to any application. At the end of each work day, Contractor shall provide a record slip of tack coat used.

Application crew shall verify temperature of liquid material using a certified thermometer prior to application, in presence of the Inspector. There is no exception to this requirement to seal all cold and hot joints.

The Contractor shall provide a submittal of the material to be utilized. All materials must be approved by the NJDOT. All others will be rejected.

Furnish and apply DeTack, manufactured by Crafco, or equal, to all joint sealer surfaces, immediately after all joints are sealed, using a pressurized garden pump sprayer. No exceptions: this will eliminate tracking of the material.

1.08.04 Method of Measurement and Payment

The cost for which payment will be made shall be included in the Lump Sum Bid Price for the project, which shall include all labor, equipment, and material needed to establish a safe work zone, provide cleaning equipment, proper supervision, trained labor, removal, and all else necessary to provide uniform tack coat. A record slip of the amount of tack coat used is required for payment.

There is no specific pay item for the Asphalt Releasing Agent. The cost of this material shall be included in the Lump Sum Bid Price for the project.

There is no specific payment for applying the DeTack and the cost thereof shall be included in the Lump Sum Bid Price for the project.

1.09 SELECT FILL

1.09.01 Scope of Work

Under this item, the Contractor shall furnish, deliver, and place select fill as required within the roadway base where unsuitable material was previously excavated or where additional fill is required to bring the roadway to proper sub base grade in accordance with the plans, as specified herein, or as directed by the Engineer. Where no roadway subbase presently exists, the Contractor shall be required to construct a soil aggregate sub grade as designated on the plans or as directed by the Engineer.

1.09.02 Materials

The Owner will accept soil aggregate the specifications as written in the 2019 NJDOT Standard Specifications for Road and Bridge Construction, Section 203. Soil Aggregate should meet I-9 or I-11 designation.

Millings (RAP) are permitted for use as sub-base material under proposed impervious surfaces (HMA, concrete, etc.). They shall be mixed with DGA. Millings are not permitted as fill in areas that are to be pervious (grass, stone, etc.).

Submittal Requirement: The Contractor shall provide submittals for the Soil Aggregate to be supplied, illustrating conformance to the NJDOT Standard Specifications. The submittal must be approved by the Engineer prior to using any imported Soil Material.

1.09.03 Methods of Construction

The Contractor shall place the aggregate material within the roadway areas once the roadway excavation operation or scarify, pulverize, excavate, blend, grade of existing sub-base procedure has been completed. The Contractor shall place the material along the roadway areas to the limits and depth as indicated on the plans and as detailed or as directed by the Engineer.

Once placed, the material shall be blended with the existing scarified and pulverized sub-base to form a uniform sub base mixture, and shall be shaped and rolled to the typical cross sections as noted, and rolled to the satisfactory compaction as stipulated in the NJDOT Standard Specifications for Road and Bridge Construction, 2019, or as amended. The Contractor shall allow for losses, shrinkage, and compaction in the overall cost. The Contractor will use the survey details to bring the failed trenches up to grade using select fill.

The Contractor shall also be required to place the material in areas designated by the Engineer for excavation where there is unstable, unsuitable soil material that exists along the pavement base. The material shall be placed, graded, and rolled to form a stable base. Where no pavement subbase presently exists, the Contractor shall be required to construct an aggregate subbase for the thickness and width as designated on the plans or as directed by the Engineer.

At no cost to Owner, the Contractor will be responsible for restoring all excavated areas prior to the end of the workday so that they are flush with the road and do not sink when driven over. The Contractor will be required to make sure the excavated areas are compacted properly and do not affect the rideability of the road.

Compaction testing shall be completed in accordance with 203.03.02.C of the NJDOT Standard Specifications for Road and Bridge Construction, 2019, or as amended in all pavement areas on the DGA stratum.

Owner will direct Contractor when nuclear densometer testing shall be scheduled, in order to be assured that the process is working, and that the minimum 95-percent compaction is attainable.

1.09.04 Method of Measurement and Payment

The cost of select fill for which payment will be made shall be included in the Lump Sum Bid Price for the project and shall be based upon the actual volume constructed as required in accordance with the plans, as specified above, or as directed by the Engineer. The Contractor must provide certified weight slips for all select fill material delivered to the job site.

Payment for select fill shall be included in the Lump Sum Bid Price for the project, and shall include the cost of preparing subgrade, placement of select fill in and along the roadway area including grading and scarification, pulverization, blending, shaping, compaction, etc., all materials, labor, equipment and all else necessary therefore and incidental thereto.

1.10 SOIL CEMENT MODIFICATION

1.10.01 Scope of Work

The Contractor shall furnish and deliver all material, labor, equipment, supervision and all else necessary and incidental to performing all specified and unspecified construction for furnishing, placing, compacting and curing a mixture of soil material, Portland cement and water. The mixture shall be uniformly mixed, blended, compacted, finished and cured as specified. It shall conform to the lines, grades, thickness and cross-sections as required on the plans, at a minimum of 12" depth, unless otherwise specified.

Under this item the Contractor shall include all costs associated with mobilization and demobilization.

1.10.02 Materials

Materials shall meet the requirements as follows:

(a) Soil/aggregate – may consist of any combination of gravel, stone, sand, silt and clay, or any high-quality crushed stone and gravel base course aggregates. The soil/aggregate shall not contain roots, topsoil, sod, brush or any deleterious material. 100% of the soil/aggregate shall pass a 1-1/2" sieve and at least 60% shall pass a No. 4 sieve, exclusive of any gravel or stone retained on the No. 4 sieve.

(b) Portland Cement – shall comply with the latest specifications for Portland Cement (ASTM C150 or AASHTO M85) or blended hydraulic cements (ASTM C595, ASTM C1157 or AASHTO M240). It shall be furnished in bags, barrels or bulk. A 6% mixture shall be worked into the materials.

(c) Water – shall be clean and free from deleterious materials, including oil, acid, alkali, organic matter, etc.

(d) Pozzolanic Materials – including fly ash slag and silica fume, if used, shall comply with the requirements of ASTM C618 Class C of F, Specifications for Fly Ash and Raw or Calcined Natural Pozzolan.

1.10.03 Methods of Construction

All Site Preparation, Excavation, Grading and Execution shall result in uniformity across the area to be treated. In addition, the Contractor shall do the following:

(f) The subgrade placement area shall be graded, shaped and compacted in conformance with the final lines and grades shown on the drawings. Any unsuitable materials shall be removed and replaced with acceptable material. The subgrade shall firmly support the construction equipment. Immediately before the placement of the soil cement, the compacted subgrade surface shall be moistened to approximately the same moisture content as specified for the soil cement, and shall be kept moist until the soil cement is placed.

(g) Soil cement material shall not be mixed when the soil/aggregate is frozen, or when the air temperature is below 40° F.

(h) Before cement is applied, initial pulverization or scarification may be required to the full depth of mixing. For cohesive soils with a plasticity index greater than 20, the soil/aggregate shall be damp at the time of pulverizing to reduce dust and aid in processing. For slurry application of cement, initial pulverization shall be performed to provide a method to uniformly distribute the slurry over the soil/aggregate.

(i) 6% cement shall be applied uniformly in a manner that minimizes dust, runoff and ponding and is satisfactory to the engineer.

(j) Mixing shall begin as soon as possible after the cement has been spread and shall continue until a uniform mixture is produced. The final mixture shall be pulverized such that 100% passes the 1-1/2" sieve and at least 60% passes the No. 4 sieve, exclusive of any gravel or stone retained on the No. 4 sieve. The final pulverization test shall be made at the conclusion of mixing operations. Mixing shall be continued until the product is uniform in color, meets gradation requirements and is at a moisture content that allows compaction to the required density. The entire operation of cement spreading, water application and mixing shall result in a uniform soil/aggregate, cement and water mixture for the full design depth and width.

(k) Soil cement materials shall be uniformly compacted to a minimum of 98% of maximum dry density based on a moving average of five consecutive test with no individual test below 96%.

(l) As compaction nears completion, the surface of the soil cement modification area shall be shaped to the specified lines, grades and cross sections. Compaction shall then be continued until uniform and adequate density is obtained. Compaction and finishing shall be done in such a manner as to produce a dense surface free of compaction planes, cracks, ridges or loose materials.

(m) Finished portions of soil cement modification areas that are traveled on by equipment used in construction shall be protected in such a manner as to prevent equipment from damaging any completed work. If required by the engineer, after completing final finishing, the surface may be moist cured with a fog-type water spray. Completed portions can be opened immediately to construction equipment provided any moist-curing operations are not impaired.

(n) Subsequent subbase and base layers can be placed any time after finishing, as long as the soil cement areas are sufficiently stable to support the required construction equipment without marring or permanent distortion of the surface.

(o) The contractor shall maintain the soil cement surface areas in good condition until all work is completed and accepted. This shall be done at the contractor's own expense. Maintenance shall include any immediate repairs or defects that may occur. If it is necessary to replace any processed materials, the replacement shall be for the full depth, with vertical cuts, using fresh soil cement materials.

1.10.04 Method of Measurement and Payment

The cost for Soil Cement Modification shall be included in the Lump Sum Bid Price, under the Alternate Bid Item, for the project for all areas where deemed necessary, to a depth of 12" below the proposed full depth pavement box.

Payment for Soil Cement Modification shall be included in Lump Sum Bid Price (Alternate Bid Item) for the project and shall include all the work noted on the plans, including the cement material, watering, curing, inspection and all incidental operations, as herein specified, or as directed by the Engineer.

1.11 CONCRETE WORK

1.11.01 Scope of Work

Under this item, the Contractor shall install reinforced concrete pads at the overhead door entrances to the Auto Shop and as aprons in front of the overhead doors on the Welding Room Addition, as designated on the construction plans or as directed by the Engineer.

1.11.02 Materials

The following material shall be used for this project:

Reinforced Concrete Pad, 6" Thick (4,500 psi minimum)
6" x 6" 10/10 Welded Wire Fabric
¾" Clean Stone

The contractor shall supply an approved concrete washout station. Open wash out onto soil, asphalt, old concrete is NOT permitted. Washout into a plastic trash bag is NOT permitted. A washout station that can collect the washout with all the water used to allow the concrete to become hardened and later cleaned must be furnished, delivered, and used on site for all concrete trucks.

A WASHOUT STATION IS REQUIRED TO BE ON-SITE DURING ALL CONCRETE OPERATIONS.

1.11.03 Methods of Construction

Reinforced concrete pad shall be reinforced with 6" x 6", 10/10 welded wire fabric and a 6" layer of ¾" clean stone below.

The Contractor shall give the Engineer 48 hours' notice to verify and approve the formwork, in accordance with Section 606.03.02 of the NJDOT Standard Specifications. Contractor shall pour concrete within 24 hours of the formwork approval to ensure forms are not disturbed between Engineer's approval of formwork and pouring of concrete.

Contractor to ensure that surface of concrete is straight without any dips or rises in the surface.

This item includes the installation of stable clean stone sub-base, 6-inches thick below concrete where necessary.

1.11.04 Method of Measurement and Payment

The cost for which payment will be made for the reinforced concrete pads shall be included in the Lump Sum Bid Price for the project, and shall include the cost of furnishing and placing the concrete, welded wire fabric, furnishing and placing the forms, placing and grading any backfill, placing and compacting ¾" clean stone sub-base, all reinforcing wire, and all finishing work as specified for the specific type of concrete work as indicated on the plans, as above specified, or as directed by the Engineer, including all labor, equipment, etc. necessary therefore or incidental thereto.

The cost of the washout station and all the costs for labor, delivery, pick-up, etc. shall be included in the Lump Sum Bid Price for the project.

1.12 TOPSOIL, FERTILIZER & SEED

1.12.01 Scope of Work

Under this Section, the Contractor shall furnish all materials, labor, equipment, etc. necessary to excavate, place, grade and level topsoil; lime and fertilize topsoil to form a suitable seed bed; and install seed on all disturbed areas as indicated on the plans, specified herein, or as directed by the Engineer.

The Contractor is required to import topsoil included in the price for this bid item.

1.12.02 Materials

A. Topsoil: The topsoil shall be friable and loamy, free of debris and objectionable weeds and stones, and contain no toxic substance that may be harmful to plant growth. The topsoil shall comply with subsection 917.01 of the NJDOT Standard Specifications for Road and Bridge Construction, 2019 or as amended.

B. Fertilizer and Lime

1. Fertilizer
   a) 10-20-10 Commercial designation — Subsection 917.03
   b) 5-10-10 Commercial designation
2. Pulverized dolomite limestone — Subsection 917.04

C. Seed

1. The material used under this Section shall be a NJDOT grass seed mixture Type A, in the proportion listed below or as specified by the Engineer.

2. Seed mixture shall be labeled to show compliance with the requirements of the New Jersey State Seed Law and shall have been tested within 6 months preceding the date of sowing. The kinds and amounts shall be as indicated:

Type A-4 Grass Seed Mixture (400 pounds per acre)

Kind of Seed	Minimum Purity, %	Minimum Germination, %	% of Total Weight of Mixture
Tall Fescue	95	80	60
Kentucky Bluegrass	85	75	10
Chewing or Hard Fescue	95	85	20
Perennial Ryegrass	98	85	10

1.12.03 Methods of Construction

When using on site materials to manufacture finished grade topsoil, the contractor shall first mechanically screen the soil. The requirements of the screened topsoil consist of the following: It shall not contain stones, organic debris, roots, or similar objects larger than ½" in any dimension.

Topsoil shall be placed in all areas where seeding is required at a minimum thickness of 4 inches. Weather conditions must be dry when placing topsoil.

Topsoil shall be fine graded to eliminate rough and low areas. Maintain elevations to comply with the grading plans.

Remove roots, weeds, rocks and foreign material while spreading.

Manually spread topsoil close to plant life to prevent damage, including natural wood lines in proximity to field areas.

Lightly compact placed topsoil and hand rake to ensure grades and unsuitable material removal.

Remove surplus subsoil and topsoil from work area and stabilize on-site utilizing temporary vegetative cover requirements noted on the project design plans.

Prior to the commencement of seeding/sod operations, the Contractor shall walk the areas and ensure there are no stones, organic debris, roots, similar objects, or foreign materials larger than ½" in any dimension. Any unsuitable material found shall be removed by hand rake.

1.12.04 Method of Measurement and Payment

The cost of Topsoil, Fertilizer, & Seed for which payment will be made shall be included in the Lump Sum Bid Price for the project, in accordance with the plans, as specified herein, or as directed by the Engineer, and shall include, but not necessarily be limited to, the cost of providing all materials, stripping, stockpiling, storing, delivery and installation of materials, watering, etc., all as above described, including all labor, equipment, supervision, and all else necessary therefore and incidental thereto for a complete and satisfactory installation.

1.13 TRAFFIC PAINT / WHEEL STOPS

1.13.01 Scope of Work

The work to be included under this item will consist of applying white, blue and/or yellow traffic paint on bituminous concrete or HMA in accordance with the Plans and Specifications, or as directed by the Engineer.

Furnish and install concrete wheel stops with No. 5 Rebar anchors into the HMA.

1.13.02 Materials

The materials to be used under this item shall conform to the materials specified under Subsection 610.02.

Submittals shall be provided in accordance with the NJDOT Standard Specifications for all traffic paint and must be approved by the Engineer prior to installation.

Stop bars, crosswalks, and directional arrows shall be long life Epoxy-Resin and be installed as stipulated in the NJDOT Standard Specifications for Road and Bridge Construction, 2019, or as directed by the Engineer.

4" Traffic stripes shall be long life Thermoplastic and be installed as stipulated in the NJDOT Standard Specifications for Road and Bridge Construction, 2019, or as directed by the Engineer.

1.13.03 Methods of Construction

The Contractor shall adhere to the methods found in Section 610.03 of the NJDOT Standard Specifications for Road and Bridge Construction, 2019 or as amended.

1.13.04 Method of Measurement and Payment

The cost for which payment will be made for linear installations of Traffic Paint shall be included in the Lump Sum Bid Price for the project.

The cost for which payment will be made for Concrete Wheel Stops shall be included in the Lump Sum Bid Price for the project.

1.14 TESTING

1.14.01 Scope of Work

Provide full-time densometer testing crew during all finish paving operations. This will not be measured for payment.

The densometer shall conclude that the density reaches 95-percent of the maximum density of the HMA mix design.

1.14.02 Materials & Methods of Construction

A. Concrete Cylinder Testing

Concrete cylinder testing shall be in accordance with 903.03.05 of the NJDOT Standard Specifications for Road and Bridge Construction, 2019 or as amended.

Use 4 × 8-inch (diameter × height) compression test cylinders, except use 6 × 12-inch (diameter × height) test cylinders for concrete mixes containing coarse aggregate sizes exceeding a nominal maximum size of 1 inch. Three (3) cylinders shall be created per concrete batch, and tested for 7, 14 and 28-day breaks.

1.14.03 Method of Measurement and Payment

Concrete Cylinder Testing shall be included in the Lump Sum Bid Price for the project. Note that the school will have a 3rd party testing facility on hand to verify all compaction testing.

1.15 DUST CONTROL

1.15.01 Scope of Work

Contractor shall provide a water truck during all construction activities to provide dust control.

There will be no separate payment for providing a water truck for dust control. The cost of providing a water truck for dust control will be distributed in various pay items.

1.15.02 Materials

Water truck capable of spraying water for dust control.

1.15.03 Methods of Construction

All methods of dust control shall conform to 2014 Standards for Soil Erosion and Sediment Control in New Jersey, or as amended.

1.15.04 Method of Measurement and Payment

There will be no separate payment for providing a water truck for dust control. The cost of providing a water truck for dust control shall be included in the Lump Sum Bid Price for the project.

1.16 SOIL EROSION ITEMS

1.16.01 Scope of Work

Under this item, the Contractor shall furnish and deliver all materials, equipment, labor, supervision and all else necessary and incidental for the installation and implementation of soil erosion measures in those locations as indicated on the plans, specified herein, or as directed by the Engineer.

1.16.02 Materials

(a) SILT FENCE

Silt Fence shall conform to the detail as shown on the plans and in conformance with SCD requirements.

(b) STABILIZED CONSTRUCTION ENTRANCE

Construction Entrance shall conform to the detail as shown on the plans and in conformance with SCD requirements. The stones noted in the detail must conform with Section 901.08 of the Standard Specifications for Road and Bridge Construction, 2019 or as amended.

1.16.03 Methods of Construction

(a) SILT FENCE

Silt Fence shall be installed downstream of proposed construction in areas indicated either on the Plan, within these specifications, or as directed by the Engineer.

Bury a minimum of one-foot of geotextile below grade.

Securely fasten geotextile to post, four to six fasteners per post.

Securely fasten ends of individual rolls of geotextile to a post by wrapping each end of the geotextile around the post twice and fastening geotextile to post, four to six fasteners per post. Splicing of individual rolls shall not be permitted at low points.

Where indicated or as required, silt fences shall be constructed. The Contractor shall remove silt build up as required to maintain the silt fence in good operating condition, and shall remove the silt fence when it is no longer needed.

(b) CONSTRUCTION ENTRANCE

The Contractor shall install the construction entrance in the locations noted on the plans. Prepare the surface by trimming or grading to the proper elevation. Lay the filter fabric, providing enough fabric to wrap the entire entrance. The Construction Entrance shall be installed in accordance with NJ Soil Erosion and Sediment Control Standards, in the location as indicated on the plan or as directed by the Engineer. All construction traffic shall enter and exit the project site through this entrance.

1.16.04 Method of Measurement and Payment

Payment for silt fence shall be included in the Lump Sum Bid Price for the project and shall include, but not necessarily be limited to, the cost of all layout, excavation and post and rail installation, backfill, compaction, etc. including all labor, including all labor, material, equipment and all else necessary therefore and incidental thereto.

The quantity for construction entrance will not be measured; it shall be included in the Lump Sum Bid Price for the project.

-- END OF DIVISION 1 SITE WORK --

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mix design, placement procedures, and finishes.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.

1.4 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments. Do not start concrete production until data has been reviewed and approved by the engineer.

C. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures.

D. Welding Certificates: Copies of certificates for welding procedures and personnel.

E. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:

F. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:

1. Cementitious materials and aggregates.
2. Form materials and form-release agents.
3. Steel reinforcement and reinforcement accessories.
4. Admixtures.
5. Curing materials.
6. Floor and slab treatments.
7. Vapor retarders.
8. Epoxy joint filler.

9. Joint-filler strips.
10. Repair materials.
11. Form liners
12. Reglets
13. Vapor retarder/barrier

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed concrete Work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for formwork and shoring and reshoring installations that are similar to those indicated for this Project in material, design, and extent.

C. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

1. Manufacturer must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.

D. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548. Contractor shall provide a storage box for concrete cylinders.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

E. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.

F. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."

G. ACI Publications: Comply with the following, unless more stringent provisions are indicated:

1. ACI 301, "Specification for Structural Concrete."
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials." CRSI

H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1. Before submitting design mixes, review concrete mix design and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixes.
c. Ready-mix concrete producer.
d. Concrete subcontractor.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.
2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

a. High-density overlay, Class 1, or better.

B. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.

C. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

D. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch (25 mm) to the plane of the exposed concrete surface.
2. Furnish ties that, when removed, will leave holes not larger than 1 inch (25 mm) in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

B. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

2.3 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected or CRSI Class 2 stainless-steel bar supports.

B. Joint Dowel Bars: Plain-steel bars, ASTM A 615/A 615M, Grade 60. Cut bars true to length with ends square and free of burrs.

C. All hooks, unless otherwise noted, shall conform to "ACI Standard Hooks".

D. Tie-wire shall not be less than 16 gauge wire

2.4 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I/II.

B. Normal-Weight Aggregate: ASTM C 33, uniformly graded, and as follows:
1. Nominal Maximum Aggregate Size: 3/4 inch.

C. Fly Ash : ASTM C618, Type F

D. Water: Potable and complying with ASTM C 94.

2.5 ADMIXTURES

A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.

B. Air-Entraining Admixture: ASTM C 260.

C. Water-Reducing Admixture: ASTM C 494, Type A.

D. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.

E. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.

F. Water-Reducing and Retarding Admixture" ASTM C 494, Type D.

2.6 VAPOR BARRIER SYSTEM

A. Vapor Barrier System: ASTM E 1745, Class A, polyolefin sheet, not less than 10 mil.

B. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a No. 4 sieve and 10 to 30 percent passing a No. 100 sieve; meeting deleterious substance limits of ASTM C 33 for fine aggregates.

C. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

2.7 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Clear, Solvent-Borne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

1. Evaporation Retarder:

   a. Sure Film; Dayton Superior Corporation.
   b. Eucobar; Euclid Chemical Co.
   c. E-Con; L&M Construction Chemicals, Inc.
   d. Confilm; Master Builders, Inc.
   e. Waterhold; Metalcrete Industries.
   f. Rich Film; Richmond Screw Anchor Co.
   g. SikaFilm; Sika Corporation.
   h. Finishing Aid; Symons Corporation.

2. Clear, Solvent-Borne, Membrane-Forming Curing Compound:

   a. Nitocure S; Fosroc.
   b. Cure & Seal 309; Kaufman Products Inc.
   c. L&M Dress & Seal 18; L&M Construction Chemicals, Inc.
   d. CS-309; W. R. Meadows, Inc.
   e. Seal N Kure; Metalcrete Industries.
   f. Rich Seal 14 percent UV; Richmond Screw Anchor Co.
   g. Kure-N-Seal; Sonneborn, Div. of ChemRex, Inc.
   h. Clear Seal 150; Tamms Industries Co., Div. of LaPorte Construction Chemicals of North America, Inc.

3. Clear, Waterborne, Membrane-Forming Curing Compound:

   a. Safe Cure and Seal; Dayton Superior Corporation.
   b. Aqua Cure VOX; Euclid Chemical Co.
   c. Dress & Seal WB; L&M Construction Chemicals, Inc.
   d. Vocomp-20; W. R. Meadows, Inc.

e. Metcure; Metalcrete Industries.
f. Cure & Seal 150E; Nox-Crete Products Group, Kinsman Corporation.
g. Cure & Seal 14 percent E; Symons Corporation.
h. Seal Cure WB 150; Tamms Industries Co., Div. of LaPorte Construction Chemicals of North America, Inc.

2.8 RELATED MATERIALS

A. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Epoxy Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Shore A hardness of 80 per ASTM D 2240.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy-Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements, and as follows:

1. Type II, non-load bearing, for bonding freshly mixed concrete to hardened concrete.
2. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
3. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Reglets: Fabricate reglets of not less than 0.0217-inch- thick galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

F. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.9 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Topping: Traffic-bearing, cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5700 psi at 28 days when tested according to ASTM C 109/C 109M.

2.10 CONCRETE MIXES

A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:

1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.

B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.

C. Footings and Foundation Walls: Proportion normal-weight concrete mix as follows:

1. Compressive Strength (28 Days): 4000 psi.
2. Maximum Slump: 3 inches.
3. Maximum Slump for Concrete Containing High-Range Water-Reducing Admixture: 8 inches after admixture is added to concrete with site-verified 2- to 3-inch slump.

D. Slab-on-Grade: Proportion normal-weight concrete mix as follows:

1. Compressive Strength (28 Days): 4000 psi.
2. Maximum Slump: 4 inches.

E. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 25 percent.

F. Maximum Water-Cementitious Materials Ratio: 0.40 for concrete required to have low water permeability. This includes elevator pits and basement walls.

G. Maximum Water-Cementitious Materials Ratio: 0.40 for concrete exposed to deicers or subject to freezing and thawing while moist. This includes exterior slabs and walls.

H. Maximum Water-Cementitious Materials Ratio: 0.40 for corrosion protection of steel reinforcement in concrete exposed to chlorides from deicing chemicals, salt, saltwater, brackish water, seawater, or spray from these sources.

I. Maximum Water-Cementitious Materials Ratio: 0.40 for all interior slabs.

J. Air Content: Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content as follows within a tolerance of plus 1 or minus 1.5 percent, unless otherwise indicated:

1. Air Content: 5.5 percent for 1-1/2-inch- nominal maximum aggregate size.
2. Air Content: 6 percent for 1-inch- nominal maximum aggregate size.
3. Air Content: 6 percent for 3/4-inch- nominal maximum aggregate size.

K. Do not air entrain concrete to trowel-finished interior floors and suspended slabs. Do not allow entrapped air content to exceed 3 percent.

L. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

M. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
4. Use corrosion-inhibiting admixture in concrete mixes where indicated.

2.11 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.12 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and ASTM C 1116, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Only when specifically approved by the Architect. Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least one and one-half minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

1. Class A, 1/8 inch for surfaces exposed to view.
2. Class C, 1/2 inch all other surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.

1. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Do not chamfer corners or edges of concrete.

J. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

K. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

L. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

M. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor bolts, accurately located, to elevations required.
2. Install reglets to receive top edge of foundation sheet waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork, for sides of beams, walls, columns, and similar parts of the Work, that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained.

B. Leave formwork, for beam soffits, joists, slabs, and other structural elements, that supports weight of concrete in place until concrete has achieved the following:

1. At least 70 percent of 28-day design compressive strength.

C. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

D. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 SHORES AND RESHORES

A. Comply with ACI 318, ACI 301, and recommendations in ACI 347R for design, installation, and removal of shoring and reshoring.

B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.

C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 VAPOR BARRIER SYSTEM

A. Vapor Barrier System: Place, protect, and repair vapor-barrier sheets according to ASTM E 1643 and manufacturer's written instructions. Lap joints 6 inches minimum and seal with manufacturer's tape.

3.6 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor barrier. Repair damage and reseal vapor barrier before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

1. Shop- or field-weld reinforcement according to AWS D1.4, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire fabric in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.7 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form from preformed galvanized steel, plastic keyway-section forms, or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-third of concrete thickness, as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete as soon as possible when cutting action will not dislodge aggregate or otherwise damage surface usually 1 to 2 hours depending on mix design, environmental conditions, etc. and before concrete develops random contraction cracks, typically 1 to 2 hours depending on mix design, environmental conditions, etc.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 7 Section "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Dowel Joints: Install dowel sleeves and dowels or dowel bar and support assemblies at joints where indicated.

1. Use dowel sleeves or lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.8 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement, unless approved by Architect.

C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation. Limit Free-Fall to a height of five (5) feet.

D. Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic, to avoid cold joints.

1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.

2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the vibrator. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, free of humps or hollows, before excess moisture or bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.

G. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.9 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding ACI 347R limits for class of surface specified.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch in height.

1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.
2. Do not apply rubbed finish to smooth-formed finish.

C. Rubbed Finish: Apply the following to smooth-formed finished concrete:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.10 FINISHING FLOORS AND SLABS

A. General: Comply with recommendations in ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes.

1. Apply scratch finish to surfaces indicated and to surfaces to receive concrete floor topping or mortar setting beds for ceramic or quarry tile, portland cement terrazzo, and other bonded cementitious floor finishes.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish: After applying float finish, apply first trowel finish and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system
2. Finish surfaces to the following tolerances, measured within 24 hours according to ASTM E 1155/E 1155M for a randomly trafficked floor surface:

   a. For thin-set flooring or resilient floor covering: Specified overall values of flatness, F(F) 35; and levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and levelness, F(L) 17.

   b. For carpet floors: Specified overall values of flatness, F(F) 25; and levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and levelness, F(L) 15.

E. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.11 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete Work.

B. Curbs: Provide monolithic finish to interior curbs where indicated by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

3.12 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing by one or a combination of the following methods:

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

    a. Water.
    b. Continuous water-fog spray.
    c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

    a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
    b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
    c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer recommends for use with floor coverings.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.13 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least six months. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid epoxy joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.14 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's

written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.

5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least 3/4 inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mix as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.15 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage and pay for a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include those specified in this Article.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mix exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mix placed each day.

    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mix, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

3. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
4. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.

5. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
6. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
7. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of four standard cylinder specimens for each composite sample.

    a. Cast and field cure one set of four standard cylinder specimens for each composite sample.

8. Compressive-Strength Tests: ASTM C 39; test two laboratory-cured specimens at 7 days and two at 28 days.

    a. Test two field-cured specimens at 7 days and two at 28 days.
    b. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at age indicated.

C. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

D. Strength of each concrete mix will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

E. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-and 28-day tests.

F. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

G. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Architect.

END OF SECTION 03300

SECTION 04211 - BRICK MASONRY UNITS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Brick masonry units.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. C 33 - Specification for Concrete Aggregates.
   2. C 67 - Test Methods of Sampling and Testing Brick and Structural Clay Tile.
   3. C 126 - Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units.
   4. C 216 - Specification for Facing Brick.
   5. C 270 - Specification for Mortar for Unit Masonry.

B. International Building Code (IBC) adopted addition

C. Building Code Requirements and Specification for Masonry Structures (TMS 402,602/ACI 530,530.1/ASCE 5,6) adopted addition

1.03 SUBMITTALS

A. Product Data, and Evaluation Reports as required for installation.

B. Shop Drawings: Include elevations of each wall indicating type and layout of units.

C. Samples: Include samples of stretcher units in sufficient quantity to illustrate color range.

D. Test Reports from an independent testing laboratory showing compliance with applicable specifications.

1.04 QUALITY ASSURANCE

A. Inspection: Periodic inspection of mortar, connector and installation should be performed as per International Building Code or Specification for masonry Structures (TMS 602/ACI 530.1/ASCE 6) (The designer may choose not require special inspection for masonry veneer in occupancy category I, II or III structures)
   1. Employ a qualified masonry inspector for periodic inspection of the masonry work. Acceptance by a State or municipality having a program of examining and certifying masonry inspectors will be considered adequate qualifications. The masonry inspector shall visit site periodically during all masonry construction and perform the following duties:
      a. Review Drawings and Specifications and meet with the CONTRACTOR to discuss requirements before work commences.
      b. Before masonry work commences, CONTRACTOR and the Contractor's Quality Control Representative shall attend meeting with ENGINEER to review the requirements for surveillance and quality control of the masonry work.
      c. Check brand and type of cement, lime (if used), and source of sand.

d. Ensure that foundation is clean, rough, and ready to receive units.
e. Observe field proportioning of mortar. Visually check aggregate to determine uniformity of grading, cleanliness, and moisture.
f. Ensure that joints are full of mortar and kept tight during work. Ensure that masons keep the cavity between the brick veneer and the back up clean of mortar droppings and inspect to determine compliance.
g. Perform or supervise performance of required sampling and testing.

2. Keep complete record of inspections. Report to the Contractor's Quality Control Representative the progress of the masonry inspection.

B. Mock-up:
1. Prior to starting construction of masonry, construct minimum 4 foot square mock-up.
2. Use accepted materials, containing each different kind and color of brick masonry units to illustrate wall design.
3. Show color range, texture range, bond, mortar color, joint tooling, critical design details and quality of workmanship.
4. Masonry construction may not proceed until the Architect./ Engineer approves mock-up.
5. When not accepted, construct another mock-up.
6. When accepted, mock-up will be standard of comparison for remainder of masonry work.
7. Upon completion and acceptance of Project, dispose of mock-ups in legal manner at offsite location.

C. Certification: Furnish manufacturer's certification that clay brick units provided meet or exceed the requirements of this specification.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units above ground to prevent contamination by mud, dust or other materials likely to cause staining or other defects.

B. Cover and protect masonry units from inclement weather to maintain quality control and physical requirements.

C. Transport and handle brick masonry units as required to prevent discoloration, chipping, and breakage.

D. Locate storage piles, stacks, and bins to protect materials from heavy traffic.

E. Remove chipped, cracked, and otherwise defective units from jobsite upon discovery.

1.06 PROJECT CONDITIONS

A. Cold Weather Requirements:
1. In accordance ACI 530.1 1.8.c
2. Provide adequate equipment for heating masonry materials when air temperature is below 40 degrees Fahrenheit.

B. Hot Weather Requirements:
1. In accordance with ACI 530.1 1.8.d

2. When ambient air temperature exceeds 100 degrees Fahrenheit, or when ambient air temperature exceeds 90 degrees Fahrenheit and wind velocity is greater than 8 miles per hour, implement hot weather protection procedures.
3. Wet mortar board before loading and cover mortar to retard drying when not being used.
4. Do not spread mortar beds more than 48 inches ahead of placing masonry units.
5. Place masonry units within one minute of spreading mortar.

C. Wetting of Brick: shall be required at the time of laying if the unit's initial rate of absorption (IRA) exceeds 30 grams per 30 square inches per minute or 1 g/ 645mm^2.

PART 2 PRODUCTS

2.01 FACE BRICK VENEER UNITS

A. Manufacturers: One of the following or approved equal:
Continental Brick. as distributed by Diener Brick

B. Type: ASTM C 216, Grade SW, Type FBS.

C. Surface Texture: unless otherwise noted on drawings: (To be selected by Architect/ENGINEER from manufacturer's full range of available textures.)

D. Colors:
1. STD 582 O/S

E. Size: _3-5/8_ inches wide by _2-3/4_ inches high by _7-5/8_ inches long, unless otherwise indicated on the Drawings.

F. Special Sizes and Shapes: As required for window and door soldier coursing and custom sills where indicated, corners, piers, lintels, control joints, and other special applications to minimize cutting.

2.02 MORTAR

Mortar shall comply ASTM C 270

2.03 TIES AND ANCHORS

All ties and anchors shall be non-corrodible or corrosion protected and shall comply with the applicable local building codes. In the absence of local building codes comply with IBC or TMS 402/ACI 530/ ASCE 6.

PART 3 EXECUTION

3.01 PREPARATION

A. Protect adjacent construction with appropriate means from mortar droppings and other effects of laying of brick masonry units.

B. Thoroughly clean foundations of laitance, grease, oil, mud, dirt, mortar droppings, and other objectionable matter.

3.02 BRICK MASONRY UNITS

A. Provide Custom Level of Quality in accordance with ASTM C216.

B. Lay units in uniform and true courses, level, plumb, and without projections or offset of adjacent units, unless indicated in the drawings.

C. Install units with full bed mortar joints. Install full vertical head joints for the thickness of units, and shove joints tightly together so that mortar bonds to both masonry units.

D. Embed veneer ties for a minimum of 1 ½ in. into the mortar joints with at least 5/8 in. exterior cover. Ties shall be mill galvanized, hot dip galvanized or stainless steel.

E. Maintain cavity space between the brick veneer and the backing clear of mortar droppings, debris, and other obstructions and materials.

F. When positions of units shift after mortar has stiffened, bond is broken, or cracks are formed, relay units in new mortar.

3.03 MORTAR JOINTS

A. Make joints straight, clean, smooth, and uniform in thickness.

B. Tooling: Tool exposed joints when thumb print hard, slightly concave. Strike concealed joints flush.

C. Joint Thickness: Make vertical and horizontal joints as required to achieve nominal dimensions on drawings and within tolerances listed in ACI530.1 Section 3.3 F.

D. Where fresh masonry joins totally or partially set masonry, clean and roughen set masonry before laying new units.

3.04 BOND PATTERN

A. Lay brick masonry units in running bond pattern, unless otherwise indicated on the Drawings.

3.05 CUTTING BRICK MASONRY UNITS

A. When possible, use full units of the proper size in lieu of cut units. Cut units as required to form chases, openings, for anchorage, and for other appurtenances.

B. Cut and fit units with power-driven carborundum or diamond disc blade saw.

3.06 CONTROL JOINTS / EXPANSION JOINTS

A. Provide in masonry walls where indicated on the Drawings.

B. Make full height and continuous in appearance.

C. Stop horizontal reinforcing at expansion joints

D. Insert control joint filler in joints as wall is constructed.

E. Insert 50% compressible neoprene expansion joint material in expansion joints.

F. Apply sealant as specified in Section 07920.

3.07 OTHER EMBEDDED ITEMS

A. Build in wall plugs, accessories, flashings, pipe sleeves, and other items required to be built-in as the masonry work progresses.

3.08 PATCHING

A. Patch exposed brick masonry units at completion of the Work and in such manner that patching will be indistinguishable from similar surroundings and adjoining construction.

3.09 MISCELLANEOUS

A. Build in required items, such as anchors, flashings, sleeves, frames, structural steel, lintels, anchor bolts, and metal fabrications, as required for complete installation.

3.10 WATER REPELLENT

A. Apply water repellent as specified in Section 07200.

3.11 FIELD QUALITY CONTROL

A. Have minimum 3 masonry units of each type proposed for Project tested in accordance with ASTM C 67 to verify conformance to Specifications.

B. Tests shall include compressive strength, severe weather water absorption requirements(24 hour cold water absorption, 5 hour boiling water absorption (if required) and C/B ratio(if required)), Initial Rate of absorption and efflorescence potential.

C. Employ and pay acceptable independent testing laboratory to perform testing.

3.12 CLEANING

A. Exercise extreme care to prevent mortar splotches.

B. Do not attach construction supports to masonry walls.

C. Wash off brick scum and mortar spills before they set.

D. Remove mortar stains from walls.

E. Clean exposed masonry. Remove scaffolding and equipment. Dispose of debris, refuse, and surplus material offsite legally.

F. Correct efflorescence on exposed surfaces with commercially prepared cleaning solution acceptable to masonry unit manufacturer.
   1. Apply cleaning solution in accordance with cleaning solution manufacturer's printed instructions.
   2. Do not use muriatic acid as cleaning solution.
   3. Do not use sandblast cleaning equipment.

3.13 PROTECTION

A. Provide temporary protection for exposed masonry corners subject to damage.

B. Bracing:
   1. Adequately brace masonry walls over 8 feet in height to prevent overturning and to prevent collapse unless wall is adequately supported by permanent supporting elements so wall will not overturn or collapse.
   2. Keep bracing in place until permanent supporting elements of structure are in place.

C. Limited Access Zone:
   1. Establish limited access zone prior to start of masonry wall construction.
   2. Zone shall be immediately adjacent to wall and equal to height of wall to be constructed plus 4 feet by entire length of wall on unscaffolded side of wall.
   3. Limit access to zone to workers actively engaged in constructing wall. Do not permit other persons to enter zone.
   4. Keep zone in place until wall is adequately supported or braced by permanent supporting elements to prevent overturning and collapse.
   5. Limit duration of vibration to time necessary to produce satisfactory consolidation without causing segregation.

END OF SECTION

SECTION 04810 - UNIT MASONRY ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes unit masonry assemblies consisting of the following when indicated:

1. Concrete masonry units.
2. Building (common) brick.
3. Mortar and grout.
4. Reinforcing steel.
5. Masonry joint reinforcement.
6. Ties and anchors.
7. Embedded flashing.
8. Miscellaneous masonry accessories.
9. Cavity-wall insulation.

B. Products furnished, but not installed, under this Section include the following:

1. Dovetail slots for masonry anchors, installed under Division 3 Section "Cast-in-Place Concrete."
2. Anchor sections of adjustable masonry anchors for connecting to structural frame, installed under Division 5 Section "Structural Steel."

C. Products installed, but not furnished, under this Section include the following:

1. Steel lintels and shelf angles for unit masonry, furnished under Division 5 Section "Metal Fabrications."
2. Manufactured reglets in masonry joints for metal flashing, furnished under Division 7 Section "Sheet Metal Flashing and Trim."
3. Hollow-metal frames in unit masonry openings, furnished under Division 8 Section "Steel Doors and Frames."

1.3 DEFINITIONS

A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 SUBMITTALS

A. Product Data: For each different masonry unit, accessory, and other manufactured product specified.

B. Shop Drawings: Show fabrication and installation details for the following:

1. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.
2. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Initial Selection: For the following:

1. Unit masonry Samples in full-scale form showing the full range of colors and textures.
2. Colored mortar Samples showing the full range of colors.

D. Samples for Verification: For the following:

1. Full-size units for each different exposed masonry unit required, showing the full range of exposed colors, textures, and dimensions to be expected in the completed construction.
2. Colored mortar Samples for each color required, showing the full range of colors expected in the finished construction. Make samples using the same sand and mortar ingredients to be used on Project. Label Samples to indicate types and amounts of pigments used.
3. Stone trim samples not less than 12 inches in length, showing the full range of colors and textures expected in the finished construction.
4. Weep holes/vents in color to match mortar color.
5. Accessories embedded in the masonry.

E. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.

1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents, unless such deviations are specifically brought to the attention of the Architect and approved in writing.

F. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

G. Material Test Reports: From a qualified testing agency indicating and interpreting test results of the following for compliance with requirements indicated:

1. Each type of masonry unit required.

   a. Include size-variation data for brick, verifying that actual range of sizes falls within specified tolerances.
   b. Include test results, measurements, and calculations establishing net-area compressive strength of masonry units.

2. Mortar complying with property requirements of ASTM C 270
3. Grout mixes complying with compressive strength requirements of ASTM C 476. Include description of type and proportions of grout ingredients.

H. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:

1. Each type of masonry unit required.
    a. Include size-variation data for brick, verifying that actual range of sizes falls within specified tolerances.
    b. Include test data, measurements, and calculations establishing net-area compressive strength of masonry units.
2. Each cement product required for mortar and grout, including name of manufacturer, brand, type, and weight slips at time of delivery.
3. Each combination of masonry unit type and mortar type. Include statement of net-area compressive strength of masonry units, mortar type, and net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.
4. Each material and grade indicated for reinforcing bars.
5. Each type and size of joint reinforcement.
6. Each type and size of anchor, tie, and metal accessory.

I. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1093 to conduct the testing indicated, as documented according to ASTM E 548.

B. Contractor shall employ and pay a qualified professional engineer to provide a survey and inspection of foundations for compliance with dimensional tolerances.

C. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.

D. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

E. Preconstruction Testing Service: The Contractor shall employ and pay for a qualified independent testing agency to perform the following preconstruction testing:

1. Concrete Masonry Unit Test: For each concrete masonry unit indicated, per ASTM C 140.
2. Prism Test: For each type of wall construction indicated, per ASTM C 1314].
3. Mortar Test: For mortar properties per ASTM C 270.
4. Grout Test: For compressive strength per ASTM C 1019.

F. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by another means, as acceptable to authorities having jurisdiction.

G. Mockups: Before installing unit masonry, build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work:

1. Locate mockups in the locations indicated or, if not indicated, as directed by Architect.
2. Build mockups for the following types of masonry in sizes approximately 48 inches long by 48 inches high by full thickness, including face and backup wythes and accessories. Include a sealant-filled joint at least 16 inches long in each mockup.

    a. Typical exterior wall with lower corner of window opening framed with stone trim at upper corner of mockup. Make opening approximately 12 inches wide by 16 inches high.

3. Clean exposed faces of mockups with masonry cleaner as indicated.
4. Where masonry is to match existing, erect mockups adjacent and parallel to existing surface.
5. Notify Architect seven days in advance of dates and times when mockups will be constructed.
6. Protect accepted mockups from the elements with weather-resistant membrane.
7. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
8. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.

    a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
    b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups, unless such deviations are specifically approved by Architect in writing.

9. Demolish and remove mockups when directed.
10. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

H. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

1. Protect Type I concrete masonry units from moisture absorption so that, at the time of installation, the moisture content is not more than the maximum allowed at the time of delivery.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver pre-blended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store pre-blended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by coverings spread on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. This specification supersedes ACI 530.1/ASCE 6/TMS 602 in that masonry shall not be installed when the ambient temperature is 32 degF or below or the temperature of the masonry units is below 32degF, unless a heated temporary enclosure is provided for a minimum of 24 hours. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602 when the ambient temperature is above 32degF. masonry products shall always be protected from the elements.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

E. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.

1. When ambient temperature exceeds 100 deg F, or 90 deg F with a wind velocity greater than 8 mph, do not spread mortar beds more than 48 inches ahead of masonry. Set masonry units within one minute of spreading mortar.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate

2.2 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.

1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to TMS 602/ACI 530.1/ASCE 6.

2.3 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE6, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work and will be within 20 feet vertically and horizontally of a walking surface.

C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.

1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

2.4 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide bullnose units for outside corners unless otherwise indicated.

B. Integral Water Repellent: Provide units made with integral water repellent for exposed units.

1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E 514/E 514M as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.

C. CMU: ASTM C90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi minimum and as noted in drawings.
2. Density Classification: Medium weight unless otherwise indicated.
3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
4. Exposed Faces: provide color and texture matching the range represented by Architect's sample.
5. Faces to Receive Plaster: Where units are indicated to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.

D. Concrete Building Brick: ASTM C 55.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2800 psi minimum and as noted in the drawings.
2. Density Classification: Medium weight.
3. Size (Actual Dimensions): 3-5/8 inches wide by 3-5/8 inches high by 7-5/8 inches long.

2.5 CONCRETE AND MASONRY LINTELS

A. General: Provide as shown in drawings.

B. Concrete Lintels: ASTM C 1623, matching CMUs in color, texture, and density classification; and with reinforcing bars indicated.

C. Concrete Lintels: Precast or formed-in-place concrete lintels complying with requirements in Section "Cast-in-Place Concrete", and with reinforcing bars indicated.

D. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforced bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.6 BRICK

A. General: Provide utility brick.

1. Provide Face Brick Manufactured by: Bowerston Shale, or Glen-Gery, or Palmetto or approved equal.

B. Provide shapes indicated and as follows for each form of brick required:

1. Provide units without cores or frogs and with exposed surfaces finished for ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces.

C. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.

1. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
2. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

D. Building Brick: ASTM C 216, Grade SW, Type FBX and as follows:

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 5,500 psi.
2. Size: Manufactured to the following actual dimensions:

a. Utility: 3-5/8 inches wide by 3-5/8 inches high by 11 5/8 inches long (Type FBX).

3. Application: Use where brick is indicated for concealed locations. Note that hollow brick is not simply face brick with the usual cores (holes); it is brick that has voids (cores and cells) exceeding 25 percent of the gross cross-sectional area. See Evaluations.

4. Color and texture: Belden Brick 8632A Velour Special Mingle or Interstate Brick Mocha-Smokey Mountain Matte Blend or approved equal.

2.7 MORTAR AND GROUT MATERIALS

A. Regional Materials: Aggregate for mortar and grout, cement, and lime shall be extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

B. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

C. Hydrated Lime: ASTM C 207, Type S.

D. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207.

E. Mortar Cement: ASTM C 1329.

F. Masonry Cement: ASTM C 91.

1. For pigmented mortar, use a colored cement formulation as required to produce the color indicated or, if not indicated, as selected from manufacturer's standard formulations.

a. Pigments shall not exceed 10 percent of portland cement by weight for mineral oxides nor 2 percent for carbon black.
b. Pigments shall not exceed 5 percent of mortar cement by weight for mineral oxides nor 1 percent for carbon black.

2. For colored-aggregate mortar, use natural color or white cement as necessary to produce required mortar color.

G. Aggregate for Mortar: ASTM C 144; except for joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.

1. White-Mortar Aggregates: Natural white sand or ground white stone.
2. Colored-Mortar Aggregates: Natural-colored sand or ground marble, granite, or other sound stone; of color necessary to produce required mortar color.

H. Aggregate for Grout: ASTM C 404.

I. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar.

J. Epoxy Pointing Mortar: ASTM C 395, epoxy-resin-based material formulated for use as pointing mortar for structural-clay tile facing units (and approved for such use by manufacturer of the units); in color indicated or, if not otherwise indicated, as selected by Architect from manufacturer's colors.

K. Cold-Weather Admixture: Permitted in accordance with ASTM C 494 Type E. No masonry work below 32 deg F.

L. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer.

M. Water: Potable.

N. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

O. Products: Subject to compliance with requirements, provide one of the following or approved equal:

1. Colored Portland Cement-Lime Mix:

a. Eaglebond; Blue Circle Cement.
b. Color Mortar Blend; Glen-Gery Corporation.
c. Rainbow Mortamix Custom Color Cement/Lime; Holnam, Inc.
d. Centurion Colorbond PL; Lafarge Corporation.

e. Lehigh Custom Color Portland/Lime; Lehigh Portland Cement Co.
f. Riverton Portland Cement Lime Custom Color; Riverton Corporation (The).

2. Mortar Cement:

a. Magnolia Superbond Mortar Cement; Blue Circle Cement.
b. Lafarge Mortar Cement; Lafarge Corporation.
c. Essroc Cement Corporation.

3. Colored Mortar Cement:

a. Magnolia Superbond Mortar Cement; Blue Circle Cement.
b. Spec Mix, Inc.
c. Montfort Bros.

4. Colored Masonry Cement:

a. Magnolia Masonry Cement; Blue Circle Cement.
b. Brixment-in-Color; Essroc Materials, Inc.
c. Rainbow Mortamix Custom Color Masonry Cement; Holnam, Inc.
d. Centurion Colorbond; Lafarge Corporation.
e. Lehigh Custom Color Masonry Cement; Lehigh Portland Cement Co.
f. Coosa Masonry Cement; National Cement Company, Inc.
g. Flamingo Color Masonry Cement; Riverton Corporation (The).
h. Richcolor Masonry Cement; Southdown, Inc.

5. Mortar Pigments:

a. True Tone Mortar Colors; Davis Colors.
b. Centurion Pigments; Lafarge Corporation.
c. SGS Mortar Colors; Solomon Grind-Chem Services, Inc.

6. Water-Repellent Admixture: See Section 07200

2.8 REINFORCEMENT

A. Uncoated-Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420).

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

C. Masonry-Joint Reinforcement, General: ASTM A 951/A 951M.

1. Interior Walls: Mill-galvanized carbon steel.
2. Exterior Walls: **STAINLESS STEEL**.
3. Wire Size for Side Rods: 0.187-inch diameter.
4. Wire Size for Cross Rods: 0.187-inch diameter.
5. Wire Size for Veneer Ties: 0.187-inch diameter.

6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
7. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

D. Masonry-Joint Reinforcement for Multiwythe Masonry:

1. Adjustable (two-piece) type, **STAINLESS STEEL** ladder design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-winged loops connections having a maximum horizontal play of 1/16 inch and maximum vertical adjustment of 1-1/4 inches. Size ties to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face.
2. Basis of Design: Hohman & Barnard #270-2X S.I.S. ladder seismiclip interlock system joint reinforcement, standard weight, with hook spacing of 16 inches on center. Provide pre-fabricated tees and corners. Approved equal substitutions will be considered in accordance with Specification Section 01300-Submittals.
3. Provide H&B stainless steel adjustable wall ties, 3/16-inch diameter pintles and 3/16-inch diameter eyes with 2X-Hooks, Locate where additional ties are required at masonry openings and veneer movement joints.

E. BRICK MASONRY JOINT REINFORCEMENT

1. Stainless steel, truss type, with two side rods, one at each face of brick, with at least 5/8" cover on outside face.

2.9 TIES AND ANCHORS

A. General: ties and anchors shall extend at least 1-1/2 inches into veneer but with at least a 5/8-inch cover on outside face.

B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:

1. Mill-Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M, with ASTM A 641/A 641M, Class 1 coating.
2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M, with ASTM A 153/A 153M, Class B-2 coating.
3. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304.
4. Galvanized-Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 (Z180) zinc coating.
5. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel with ASTM A 153/A 153M, Class B coating.
6. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.
7. Steel Plates, Shapes and Bars: ASTM A 36/A 36M.
8. Stainless-Steel Bars: ASTM A276 or ASTM A 666, Type 304.

C. Welded adjustable anchors for Connecting to Structural Steel Framing: Where indicated, or required, provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch diameter, hot-dip galvanized steel wire.

2. Tie Section: Triangular-shaped wire tie made from 0.25-inch diameter, hot-dip galvanized steel wire.
3. Basis of design: Hohman & Barnard #359-C weld-on ties, with 8 inch offsets, 1/4 inch wire, Vee-Byna tie, wire diameter to match net tie space between structural steel and inside of weld-on ties plus or minus 1/16 inch clearance max, hot dip galvanized, shop welded to steel.
4. Touch up welds with zinc-rich coating per approved shop paint SSPC-Paint 20 manufacturer's recommendations.

D. Rigid anchors can be used to connect T-intersections of CMU shear walls in lieu of masonry bonding or bond beams. They are also often used at T-intersections of other CMU walls, although masonry bonding and T-shaped masonry-joint reinforcement may be used.

E. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 or with cross pins unless otherwise indicated.

1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M.

F. Adjustable Masonry-Veneer Anchors:

1. General: Provide Stainless Steel anchors that allow vertical adjustment but resist a minimum of 100-lbf load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch.
2. Fabricate sheet metal anchor sections and other sheet metal parts from 0.078-inch thick, stainless-steel sheet.
3. Fabricate wire ties from 0.187 inch diameter, **STAINLESS STEEL** wire.
4. Screw or and post installed anchor attached, Masonry-Veneer Anchors: Wire tie and a rib-stiffened, sheet metal anchor section with screw holes top and bottom, with a projecting vertical tab having a slotted hole for inserting wire tie.

a. Attached to existing CMU

1) Basis of Design: Hohmann & Barnard HB-5213 adjustable veneer anchor with 2X-Hook and insulation retaining washer or approved equal.
2) Fasten to existing CMU with 3/8-inch diameter stainless-steel sleeve anchor (Basis of Design: Powers Fasteners, Powerbolt) hex head sleeve anchor with 1 1/4 inch embedment in CMU faceshell and located within cell of CMU per manufacturer's requirements.
3) Acceptable products:

a) CTP-516 with CTP 2" post installed stainless steel and 2" bronze expansion anchor and insulation retaining washer.
b) Or approved equal

b. Attached to steel studs

1) Basis of Design: Hohmann & Barnard H&B-213 or approved equal adjustable stainless steel veneer anchor, 2X-Hook and insulation retaining washer.

2) Fasten to steel stud with two (2) #10-16 hex head self-drilling screws with bonded neoprene washer and corrosion protective coating (Basis of Design: Hilti, Self-Drilling Screws and Kwik-Cote coating or approved equal).
3) Other acceptable products:

a) CTP-16 with fasteners noted above and insulation retaining washer.
b) Or approved equal.

c. Attached to structural steel where indicated.

1) Unless noted otherwise, Basis of Design: Hohmann & Barnard HB-213 or approved equal stainless steel adjustable veneer anchor, 2X hooks and insulation retaining washer.
2) Where indicated: Hohmann & Barnard 359-FH Stainless Steel with Vee Byna-Tie, 3 /16" wire tie diameter.
3) Fasten to structural steel with two (2) 1/4 x 20 (Basis of Design: HILTI BI-METAL KWIK FLEX with HEX or approved equal) washer head self-drilling fasteners.
4) Other acceptable products:
a) CTP-16 with fasteners noted above and insulation retaining washer.
b) Or approved equal.

2.10 FLEXIBLE FLASHING TYPE 304 STAINLESS STEEL

A. LAMINATED STAINLESS STEEL FABRIC FLASHING, NON-ASPHALTIC.

B. Definitions:

1. Cavity wall flashing: Same as flexible flashing.
2. Foundation sill flashing: Same as flexible flashing.
3. Flexible flashing: Water-proof material typically used in cavity wall construction to contain and assist in the proper water drainage that may penetrate wall system veneer. Other materials may be required to constitute the system.
4. Head and sill flashing: Same as flexible flashing.
5. Through-wall flashing:

a. Generally considered the same as flexible flashing.
b. Rare definition referred to full width cap flashing under copings or wall caps.

C. Submittals: Provide these documents in one complete shop drawings.

1. Product data: Indicate material type, composition, thickness, and installation procedures.
2. Samples: 3" by 5" flashing material.
3. Product quality and environmental submittals

a. Certificates:

1) Indicate materials supplied or installed are asbestos free.
2) Indicate recycled content: 60% total recycled material; based on 60% Post Industrial Recycled Content.

b. Minimum Performance Requirements:

1) Tensile strength, 100,000 psi minimum average
2) Puncture Resistance, 2,500 pounds average
3) When tested as manufactured, product resists growth of mold pursuant to test method ASTM D3273.
4) Fire Rating: flame spread and smoke generation
   1. Rated Class A, ASTM E84
5) Certify the use of domestic manufactured stainless steel for flashing.
6) Certify products contain no silica or asbestos.

4. Required Compatibility letter:

a. Provide compatibility letter from the Air Barrier System and Flashing System manufacturer.

D. QUALITY ASSURANCE

1. Qualifications:

a. Manufacturer: Provide flashing materials by single manufacturer with not less than twenty-five years of experience in manufacturing flexible flashing products.
b. Flashing materials must be able to withstand 300° F temperature without changing the long-term performance of the flashing.

E. Required Compatibility Letter: Provide compatibility letter from the Air Barrier System and Flashing System manufacturer.

F. Warranty

1. Special warranty:

a. Manufacturer: Warrant flexible flashing material for life of the wall
b. Begin warranty at the Date of Substantial Completion.

G. MANUFACTURED UNITS

1. Product standard of quality:

a. York Manufacturing, Inc.; Multi-Flash SS- Basis of Design.
b. Illinois Products, Inc.; IPCO Stainless Steel Fabric Flashing
c. Prosoco, Inc.; R-Guard SS ThruWall
d. STS Coatings, Inc.; Wall Guardian Stainless Steel TWF
e. TK Products, Inc.; TK TWF
f. Approved equal products that meet the criteria in section 1.04 to 1.06.

2. Characteristics:

   a. Type: **Stainless Steel** core with polymer fabric laminated to the bottom stainless steel face with non-asphalt adhesive. The top face (exposed side) must not be covered with a polymer fabric.
   b. **Stainless Steel:** type 304, ASTM A240. Domestically sourced per DFARS 252.225-7008 and/or DFARS 252.225-7009.
   c. Fabric: polymer fabric; laminated back face (non-exposed side) of stainless steel core.
   d. Size: Manufacturer's standard width rolls.

H. ACCESSORIES:

1. Mastic/sealant: The Basis of Design is York Manufacturing, Inc.; UniverSeal US100 or approved equal.

   a. Characteristics:

      1) Type: One part 100% solids, solvent-free formulated silyl-terminated polyether (STPE), ASTM C920-11, Type S, Grade NS, Class 50.

2. End dam: Provide preformed pieces by the flashing manufacturer using:

   a. Stainless steel: 26 gauge stainless steel

3. Splice material: Product standard of quality is York304 SS by York or approved equal. Manufacturer's standard self-adhered metal material; material matching system material or use Multi-Flash Stainless Steel 6" lap piece and polyether sealant as a splice.

4. Termination bar: Product standard of quality is York T-96 termination bar or approved equal. Manufacturer's standard 1" composite material bar or a 1" 26 gauge stainless steel termination bar with sealant lip.

5. Weep vent protection: Product standard of quality is York's Weep Armor or approved equal. Geotextile drainage fabric at least 12" in height.

6. Repair and other materials/accessories: Manufacturer's standard.

7. Fasteners: 304 Stainless Steel Domestic manufactured fastener types and sizes recommended by flashing manufacturer for intended use.

I. INSTALLATION

1. General

   a. Install where indicated, specified, or required in accord with flashing manufacturer's written instructions and as follows.
   b. Extend flashing 8" minimum beyond opening. Provide pre-manufactured end dam units made of 26 gauge stainless steel.
   c. Flashing width: Width required starting flush with outside face of exterior wythe, extending through cavity, rising height required to extend above lintel steel at least

2". **Flashing shall be installed a minimum of 1" past the face of veneer and cut off flush after inspection by C. M. or Architect.**

d. Splice end joints by overlapping them 6" and seal with a compatible sealant or metal splice tape.

e. Masonry back up:

1) Coordinate with fluid applied membrane air barrier installation, in accordance with manufacturer's installation instructions.
2) Embed flashing between CMU masonry installation and seal the top edge with compatible sealant.

f. Concrete back up:

1) Surface apply after fluid applied membrane air barrier installation in accordance with manufacturer's installation instructions.
2) Fasten to concrete surface at top by embedding in layer of sealant or use a non-corrosive termination bar and fasten it to the backer wall at the top edge of the flashing and seal the top edge with a compatible sealant.

g. Stud back up with sheathing:

1) Fasten to stud back-up. Install double faced butyl tape then install a non-corrosive termination bar and fasten it to the backer wall at the top edge of the flashing and seal the top edge with a compatible sealant.

h. Leave ready for certified compatible air barrier installation lapping flashing top installed in another Section.

i. Lay flashing in continuous bead of sealant on masonry supporting steel.

j. Provide purchased manufacturers preformed end dams.

k. Inside and outside corners: Provide purchase manufactured corners from manufacturer.

l. Cover flashing within a few days of installation to protect it from damage from the different trades, the environment and falling debris. If flashing is left unprotected and it is punctured, torn, or has loose scrim you should contact the manufacturer for repair instructions.

J. SCHEDULES

1. Locations:

a. Exterior door heads.
b. Window heads and sills.
c. Storefront heads.
d. Horizontal control joints.
e. Changes in veneer materials, vertically.
f. Other wall openings.
g. Other locations indicated.

2.11 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Pre-molded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane or PVC.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D226/D 226M, Type 1 (No. 15 asphalt felt).

D. Weep/Cavity Vent Products:

1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected form manufacturer's standard.

2. Products

a. Basis of Design: Hohmann & Barnard QV Quadro Vent full mortar joint height Color to match mortar
b. Or approved equal.

E. Cavity Drainage Material: Free-draining mesh, made form polymer strands that will not degrade within the wall cavity.

1. Configuration: Provide one of the following:

a. Strips, full depth of cavity and 10 inches high with dovetail-shaped notches 7 inches deep that prevent clogging with mortar droppings.
b. Strips, not less than 3/4 inch thick and 10 inches high, with dimpled surface designed to catch mortar droppings and prevent weep holes from clogging with mortar.
c. Sheets or strips, full depth of cavity and installed to full height of cavity.

F. Exterior Wall Expansion Joint Covers: Provide pre-manufactured silicone-coated, precompressed primary seal assembly at all exterior expansion joints.

G. Products: Subject to compliance with requirements, provide one of the following or approved equal:

1. Plastic Weep Hole/Vent:

a. Cell Vent; Dur-O-Wal, Inc.
b. Or Approved Equal

2. Cavity Drainage Material:

   a. Mortar Break; Advanced Building Products, Inc.
   b. CavClear Masonry Mat; CavClear.
   c. Mortar Net; Mortar Net USA, Ltd.
   d. Mortar Stop; Polytite Manufacturing Corp.
   e. Or Approved Equal

3. Reinforcing Bar Positioners:

   a. #RB Rebar Positioner; Hohmann & Barnard, Inc.
   b. #RB-Twin Rebar Positioner; Hohmann & Barnard, Inc.
   c. Or Approved Equal

4. Exterior Wall Expansion Joint Cover:

   a. Seismic Colorseal; EMSEAL LLC.
   b. Or Approved Equal

2.12 CAVITY-WALL INSULATION

A. Continuous Insulation Xci foil wall panels: Comply with NFPA 285 exterior wall assembly and ASTM C1289. Panels are a high thermal resistive rigid insulation panel composed of a closed cell Polyisocyanurate foam core bonded to an impermeable foil facer. Provide type: ASTM C1289, type 1 Grade (3) = 25 PSI thickness 1.5 inches (38 mm)/R-value 10.0. Provide panel fasteners that are corrosive resistant with length and embedment as recommended by panel manufacturer.

B. Basis of Design Product: Hunter Panels Xci Foil. Approved equal substitutions will be considered in accordance with Specification Section 01300-Submittals.

2.13 MASONRY CLEANERS

A. Job-Mixed Detergent Solution: Solution of 1/2-cup dry measure tetrasodium polyphosphate and 1/2-cup dry measure laundry detergent dissolved in 1 gal. of water.

B. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Available Products: Subject to compliance with requirements, products that may be used to clean unit masonry surfaces include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following or approved equal:

   a. Cleaners for Red and Light-Colored Brick Not Subject to Metallic Staining with Mortar Not Subject to Bleaching:

1) 202 New Masonry Detergent; Diedrich Technologies, Inc.
2) Sure Klean No. 600 Detergent; ProSoCo, Inc.
3) Florok 700 Masonry Detergent; Chargar Corporation.

b. Cleaners for Red and Dark-Colored Brick Not Subject to Metallic Staining:

1) 200 Lime Solv; Diedrich Technologies, Inc.
2) Sure Klean No. 101 Lime Solvent; ProSoCo., Inc.
3) Chargar Corporation.

c. Cleaners for Brick Subject to Metallic Staining:

1) 202V Vana-Stop; Diedrich Technologies, Inc.
2) Sure Klean Vana Trol; ProSoCo, Inc.
3) Chargar Corporation.

2.14 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Add cold-weather admixture (if used) at the same rate for all mortar, regardless of weather conditions, to ensure that mortar color is consistent.

B. Pre-blended, Dry Mortar Mix: Furnish dry mortar ingredients in the form of a pre-blended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification.

1. Extended-Life Mortar for Unit Masonry: Mortar complying with ASTM C 1142 may be used instead of mortar specified above, at Contractor's option.
2. Limit cementitious materials in mortar for exterior and reinforced] masonry to portland cement, mortar cement, and lime.
3. For masonry below grade, in contact with earth, and where indicated, use Type S.
4. For reinforced masonry and where indicated, use Type S.
5. For exterior ,veneer brick use Type N.

D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.

1. Pigments shall not exceed 10 percent of Portland cement by weight
2. Mix to match Architect's sample.
3. Application: Use pigmented mortar for exposed mortar joints with the following units:

a. Clay face brick.

E. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type fine that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
2. Self-consolidated grout where indicated (SCG): ASTM C476 fine grout, pre-batched, pre-bagged, dry ingredients ready for hydration at the project site. Site proportioned grout will be rejected.

a. Specified minimum 28-day compressive strength is 3000 psi (ASTM C1019);
b. Slump flow (ASTM C1611) 24 inches to 28 inches;
c. T50 = 2 to 5 seconds
d. Visual Stability Index (VSI) = 0;
e. Basis of Design: SPEC MIX SCG, or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.
4. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Before installation, examine rough-in and built-in construction to verify actual locations of piping connections.

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to the full thickness shown. Build single-wythe walls to the actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this Section and in other Sections of the Specifications.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to the opening.

D. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide a continuous pattern and to fit adjoining construction. Where possible, use full-size units without cutting. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

1. Mix units from several pallets or cubes as they are placed.

F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

G. Wetting of Brick: Wet brick before laying if the initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at the time of laying.

3.3 TOLERANCES

A. Dimensions and Locations of Elements: or minus 1/4 inch (6 mm).

1. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
2. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more that 1/4 inch in 10 feet, or 1/2 inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet or 1/2 inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet or 1/2 inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet or 1/2 inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet in, 3/8 inch in 20 feet or 1/2 inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet or 1/2 inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3mm), with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (9 mm) or minus 1/4 inch.

4. For exposed head joints, do not vary form thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joints and head-joint thicknesses by more than 1/8 inch.
5. For exposed bed joints and head joints of stacked bond, do not vary from straight line by more than 1/16 inch from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Lay exposed masonry in the following bond pattern; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

1. One-half running bond with vertical joint in each course centered on units in courses above and below.
2. Stack bond.
3. One-third running bond.
4. As indicated on Drawings.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: In each course, rack back one-half-unit length for one-half running bond or one-third-unit length for one-third running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly if required, and remove loose masonry units and mortar before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.

F. Fill space between hollow-metal frames and masonry solidly with mortar, unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.

H. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.

2. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
3. At fire-rated partitions, install firestopping in joint between top of partition and underside of structure above to comply with Division 7 Section "Firestopping."

3.5 MORTAR BEDDING AND JOINTING

A. Lay CMU as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs in mortar in all courses of piers, columns, and pilasters.
3. Bed webs in mortar in grouted masonry, including starting course on footings.
4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
5. Fully bed units and fill cells with grout at anchors and ties as needed to fully embed anchors and ties in mortar.

B. Lay solid masonry units and hollow brick with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Set cast-stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor and similar holes.

1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
2. Allow cleaned surfaces to dry before setting.
3. Wet joint surfaces thoroughly before applying mortar.
4. Rake out mortar joints for pointing with sealant.

D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

E. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

F. Cut joints flush where indicated to receive waterproofing, cavity wall insulation and air barriers unless otherwise indicated.

3.6 BONDING OF MULTIWYTHE MASONRY

A. Use bonding system indicated on Drawings.

B. Corners: Provide interlocking masonry unit bond in each wythe and course at corners, unless otherwise indicated.

1. Provide continuity with masonry joint reinforcement at corners by using prefabricated "L" units as well as masonry bonding.

C. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, bond walls together as follows:

1. Provide continuity with masonry joint reinforcement by using prefabricated "T" units.

3.7 CAVITY WALLS

A. Bond wythes of cavity walls together as follows:

1. Individual Metal Ties as indicated on drawings: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 1.77 sq. ft. of wall area spaced not to exceed 24 inches o.c. horizontally and 16 inches o.c. vertically. Stagger ties in alternate courses. Provide additional ties around openings and space as indicated around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.

a. Where bed joints of wythes do not align, use adjustable-type (two-piece-type) ties.
b. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable-type (two-piece-type) ties to allow for differential movement regardless of whether bed joints align.

2. Masonry-Joint Reinforcement: Installed in horizontal mortar joints.

a. Where bed joints of wythes do not align, use adjustable-type (two-piece-type) reinforcement.
b. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable-type (two-piece-type) reinforcement to allow for differential movement regardless of whether bed joints align.

3. Masonry-Veneer Anchors: Comply with requirements for anchoring masonry veneers.

B. Bond wythes of cavity walls together using bonding system indicated on drawings.

C. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity. Provide clean out units (CMU or clay facing) every other unit for the length of the work. Remove accumulated mortar at completion of each lift of work. Install cleanout unit after top of masonry is completed.

D. Parge all cavity face of backup wythe in a single coat to match existing (approximately 1/2 inch (10 mm)) thick. Trowel face of parge coat smooth to match existing and as required by the air barrier manufacturer.

3.8 ANCHORED MASONRY VENEERS

A. Anchor masonry veneers to wall framing and structural steel and masonry backup with masonry-veneer anchors to comply with the following requirements:

1. Fasten fastener-attached anchors through sheathing to wall framing and to masonry backup with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
2. Embed tie sections in masonry joints.
3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
4. Space anchors as indicated, but not more than 16 inches o.c. vertically and 16 inches o.c. horizontally, with not less than one anchor for each 1.77 sq. ft. of wall area. Install additional anchors around openings and at intervals, not exceeding 8 inches, around perimeter and as indicated.

B. Provide not less than 1 inch of airspace between back of masonry veneer and face of insulation.

1. Keep airspace clean of mortar droppings and other materials during construction. Bevel beds away from airspace, to minimize mortar protrusions into airspace. Do not attempt to trowel or remove mortar fins protruding into airspace. Provide clean out units (CMU or clay facing) every other unit for the length of the work. Remove accumulated mortar at completion of each lift of work. Install cleanout unit after top of masonry is completed.

3.9 MASONRY-JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement at minimum of 6 inches.

1. Space reinforcement not more than 16 inches o.c.
2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Install brick masonry joint reinforcement at heads and sills of openings in brick veneer as indicated. Coordinate bed joint locations with adjustable anchor/ties. Do not install joint reinforcement in the same bed joint as the anchor/ties.

3.10 ANCHORING MASONRY TO STRUCTURAL STEEL

A. Anchor masonry to structural steel, where masonry abuts or faces structural steel or concrete, to comply with the following:

1. Provide an open space not less than 1 inch wide between masonry and structural steel unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated.

3.11 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry using one of the following methods:

1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout, and rake out joints in exposed faces for application of sealant.
2. Install preformed control-joint gaskets designed to fit standard sash block.
3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar, or rake out joint for application of sealant.
4. Install temporary foam-plastic filler in head joints, and remove filler when unit masonry is complete for application of sealant.

C. Form expansion joints in brick as follows:

1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches in direction of water flow. Seal joints below grade at junctures with horizontal expansion joints if any.
2. Build flanges of factory-fabricated, expansion-joint units into masonry.
3. Build in compressible joint fillers where indicated.
4. Form open joint full depth of brick wythe and of width indicated, but not less than 1/2 inch for installation of sealant and backer rod.

D. Provide horizontal, pressure-relieving joints by either leaving an airspace or inserting a compressible filler of width required for installing sealant and backer rod but not less than 1/2 inch.

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.12 LINTELS

A. Install galvanized steel lintels where indicated.

B. Provide concrete or masonry lintels where shown and where openings of more than 12 inches (305 mm) for brick-size units and 24 inches for block-size units shown without structural steel or other supporting lintels.

C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.13 FLASHING, WEEP HOLES, WATERPROOFING AND CAVITY VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, and tape as recommended by flashing manufacturer.
2. At masonry-veneer walls, extend flashing through veneer, across airspace behind veneer, and up fact of sheathing or masonry backup in accordance with barrier system manufacturer requirements at least 8 inches; with upper edge tied into water-resistive barrier, lapping at least 6 inches. Fasten upper edge of flexible flashing to sheathing through termination bar. Provide cut off sealant above termination bar to CMU.
3. At lintels and shelf angles, extend flashing at minimum of 6 inches into masonry at each end. At heads and sills, extend flashing a minimum of 6 inches at ends and turn up not less than 2 inches to form end dams at nearest head joint.
4. Install metal drip plates beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to tope of metal drip plate.
5. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to tope of metal flashing termination.
6. Provide minimum of 3 inches lap into drip plate. Set drip plate in continuous bed of butyl sealant. Set butyl on grouted solid brick course.
7. Install continuous self-adhering base of wall waterproofing flush to exterior surface of trench foundation wall, extend horizontally inward to intersecting masonry wall and rise to the underside of through wall flashing location, terminate with termination bar to CMU wall, prime surfaces as required by approved manufacturer to provide complete adhesion.

C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

D. Install weep holes in exterior wythes and veneers in head joints of first course of masonry immediately above embedded flashing.

1. Use specified weep/cavity vent products to form weep holes.

3.14 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches.

3.15 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform test and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

C. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

3.16 REPAIRING, POINTING AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes and completely fill with mortar. Point up joints, including corners, openings and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar in thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean brick by bucket-and-brush hand-cleaning method.
6. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.
7. Clean masonry with a proprietary acidic cleaner applied according to the manufacturer's written instructions.
8. Clean stone trim to comply with stone supplier's written instructions.

9. Clean limestone units to comply with recommendations in ILI's "Indiana Limestone Handbook".

3.17 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excel masonry materials are Contractor's property. At completion of unit masonry work, remove from project site.

B. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.

C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used, as described above or recycled, and other masonry waste and legally dispose of off Owner's property.

END OF SECTION 04810

SECTION 05120 - STRUCTURAL STEEL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes structural steel.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Engineer structural steel connections required by the Contract Documents to be selected or completed by the fabricator to withstand design loadings indicated.

B. Engineering Responsibility: Engage a fabricator who utilizes a qualified professional engineer to prepare calculations, Shop Drawings, and other structural data for structural steel connections.

1.4 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for each type of product specified.

C. Shop Drawings detailing fabrication of structural steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
3. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify high-strength bolted slip-critical, direct-tension, or tensioned shear/bearing connections.
4. Include Shop Drawings signed and sealed by a qualified professional engineer responsible for their preparation.

D. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

E. Mill test reports signed by manufacturers certifying that their products, including the following, comply with requirements.

1. Structural steel, including chemical and physical properties.

2. Bolts, nuts, and washers, including mechanical properties and chemical analysis.
3. Direct-tension indicators.
4. Shop primers.
5. Nonshrink grout.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed structural steel work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Fabricator Qualifications: Engage a firm experienced in fabricating structural steel similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the Work.

C. Comply with applicable provisions of the following specifications and documents:

1. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
2. AISC's "Specification for Allowable Stress Design of Single-Angle Members."
3. AISC's "Seismic Provisions for Structural Steel Buildings."
4. ASTM A 6 (ASTM A 6M) "Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use."
5. Research Council on Structural Connections' (RCSC) "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Professional Engineer Qualifications: A professional engineer who is legally authorized to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for projects with structural steel framing that are similar to that indicated for this Project in material, design, and extent.

E. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code--Steel."

1. Present evidence that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver structural steel to Project site in such quantities and at such times to ensure continuity of installation.

B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.

1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
2. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.7 SEQUENCING

A. Supply anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 - PRODUCTS

2.1 MATERIALS AS INDICATED.

A. Structural Steel Shapes, Plates, and Bars: As follows:

1. Carbon Steel: ASTM A 36.
2. High-Strength, Low-Alloy Columbium-Vanadium Steel: ASTM A 992, Grade 50.
3. High-Strength, Low-Alloy Structural Steel: ASTM A 588, Grade 50, corrosion resistant.

B. Cold-Formed Structural Steel Tubing: ASTM A 500, Grade B.

C. Hot-Formed Structural Steel Tubing: ASTM A 501.

D. Steel Pipe: ASTM A 53, Type E or S, Grade B.

1. Weight Class: Standard unless indicated otherwise.
2. Finish: Black, except where indicated to be galvanized.

E. Carbon-Steel Castings: ASTM A 27, Grade 65-35, medium-strength carbon steel.

F. High-Strength Steel Castings: ASTM A 148, Grade 80-50.

G. Shear Connectors: ASTM A 108, Grade 1015 through 1020, headed-stud type, cold-finished carbon steel, AWS D1.1, Type B.

H. Anchor Rods, Bolts, Nuts, and Washers: As follows:

1. Unheaded Rods: ASTM A 36.
2. Headed Bolts: ASTM A 307, Grade A; carbon-steel, hex-head bolts; and carbon-steel nuts.
3. Headed Bolts: ASTM A 325, Type 1, heavy hex steel structural bolts and heavy hex carbon-steel nuts. Use where high strength bolts are indicated.
4. Washers: ASTM A 36.

I. Nonhigh-Strength Bolts, Nuts, and Washers: ASTM A 307, Grade A; carbon-steel, hex-head bolts; carbon-steel nuts; and flat, unhardened steel washers.
   1. Finish: Hot-dip zinc-coating, ASTM A 153, Class C.

J. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers.
   1. Finish: Hot-dip zinc-coating, ASTM A 153, Class C.

K. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
   1. Finish: Mechanically deposited zinc coating.

L. Welding Electrodes: Comply with AWS requirements.

2.2 PRIMER

A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer.

B. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds and repair painting galvanized steel, with dry film containing not less than 93 percent zinc dust by weight, and complying with DOD-P-21035A or SSPC-Paint 20.

2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, of consistency suitable for application, and a 30-minute working time.

2.4 FABRICATION

A. Fabricate and assemble structural steel in shop to greatest extent possible. Fabricate structural steel according to AISC specifications referenced in this Section and in Shop Drawings.

   1. Camber structural steel members where indicated.
   2. Identify high-strength structural steel according to ASTM A 6 and maintain markings until steel has been erected.
   3. Mark and match-mark materials for field assembly.
   4. Fabricate for delivery a sequence that will expedite erection and minimize field handling of structural steel.
   5. Complete structural steel assemblies, including welding of units, before starting shop-priming operations.
   6. Comply with fabrication tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel.

B. Fabricate architecturally exposed structural steel with exposed surfaces smooth, square, and free of surface blemishes, including pitting, rust, scale, seam marks, roller marks, rolled trade names and roughness.

1. Remove blemishes by filling or grinding, or by welding and grinding, prior to cleaning, treating, and shop priming.
2. Comply with fabrication requirements, including tolerance limits, of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for architecturally exposed structural steel.

C. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded.

D. Finishing: Accurately mill ends of columns and other members transmitting loads in bearing.

E. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's printed instructions.

F. Holes: Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing members, as shown on Shop Drawings.

1. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame-cut holes or enlarge holes by burning. Drill holes in bearing plates.

2.5 SHOP CONNECTIONS

A. Shop install and tighten high-strength bolts according to RCSC's Allowable Stress Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1. Bolts: ASTM A 325 high-strength bolts, unless otherwise indicated.
2. Connection Type: Snug tightened, unless indicated as slip-critical, direct-tension, or tensioned shear/bearing connections.

B. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.
2. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed fillet welds 1/2 inch and larger. Grind flush butt welds. Dress exposed welds.

2.6 SHOP PRIMING

A. Shop prime steel surfaces, except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.

2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Surfaces to receive sprayed-on fireproofing.
5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. Prepare surfaces according to SSPC specifications as follows:

1. SPC-SP 3 "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply 2 coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

D. Painting: Apply a 1-coat, nonasphaltic primer complying with SSPC's "Painting System Guide No. 7.00" to provide a dry film thickness of not less than 1.5 mils.

2.7 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel indicated for galvanizing according to ASTM A 123.

2.8 SOURCE QUALITY CONTROL

A. The Contractor will employ and pay for an independent testing and inspecting agency to perform shop inspections and tests and to prepare test reports.

1. Testing agency will conduct and interpret tests and state in each report whether test specimens comply with or deviate from requirements.
2. Provide testing agency with access to places where structural steel Work is being fabricated or produced so required inspection and testing can be accomplished.

B. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.

C. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

D. Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1. Direct-tension indicator gaps will be verified to comply with ASTM F 959, Table 2.

E. In addition to visual inspection, shop-welded connections will be inspected and tested according to AWS D1.1 and the inspection procedures listed below, at testing agency's option.

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Before erection proceeds, and with the steel erector present, verify elevations of concrete and masonry bearing surfaces and locations of anchorages for compliance with requirements.

B. Do not proceed with erection until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC specifications referenced in this Section.

B. Base and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.

1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
2. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.
3. Pack grout solidly between bearing surfaces and plates so no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.

a. Comply with manufacturer's instructions for proprietary grout materials.

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

1. Maintain erection tolerances of architecturally exposed structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.

E. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.

F. Do not use thermal cutting during erection.

G. Finish sections thermally cut during erection equal to a sheared appearance.

H. Do not enlarge unfair holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

A. Install and tighten nonhigh-strength bolts, except where high-strength bolts are indicated.

B. Install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1. Bolts: ASTM A 325 high-strength bolts, unless otherwise indicated.
2. Connection Type: Snug tightened, unless indicated as slip-critical, direct-tension, or tensioned shear/bearing connections.

C. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.

1. Comply with AISC specifications referenced in this Section for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.
3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed fillet welds 1/2 inch and larger. Grind flush butt welds. Dress exposed welds.

3.5 FIELD QUALITY CONTROL

A. Owner will employ and pay for an independent testing and inspecting agency to perform field inspections and tests and to prepare test reports.

1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from requirements.

B. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.

C. Additional testing will be performed to determine compliance of corrected Work with specified requirements. Contractor will reimburse Owner for the costs of these additional tests.

D. Field-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1. Direct-tension indicator gaps will be verified to comply with ASTM F 959, Table 2.

E. In addition to visual inspection, field-welded connections will be inspected and tested according to AWS D1.1 and the inspection procedures listed below, at testing agency's option.

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.

3.6 CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.

1. Apply by brush or spray to provide a minimum dry film thickness of 1.5 mils.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint according to ASTM A 780.

END OF SECTION 05120

SECTION 05210 - STEEL JOISTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Open-web K-series steel joists where indicated
2. Joist accessories.

1.3 DEFINITIONS

A. Special Joists: Joists requiring modification by the manufacturer to support nonuniform, unequal, or special loading conditions that invalidate SJI's "Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders."

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide special joists and connections capable of withstanding the following design loads within limits and under conditions indicated:

1. Design Loads: As indicated on the Structural Drawings

B. Design joists to withstand design loads with total load deflections no greater than the following:

1. Roof Joists: Vertical live load deflection of 1/360 of the span.

1.5 SUBMITTALS

A. Product Data: For each type of joist, accessory, and product indicated.

B. Shop Drawings: Show layout, mark, number, type, location, and spacings of joists. Include joining and anchorage details, bracing, bridging, accessories; splice and connection locations and details; and attachments to other construction.

1. Indicate locations and details of anchorage devices and bearing plates to be embedded in other construction.
2. Comprehensive engineering analysis signed and sealed by the qualified professional engineer responsible for its preparation when required.

C. Welding Certificates: Copies of certificates for welding procedures and personnel.

D. Mill certificates signed by manufacturers of bolts certifying that their products comply with specified requirements.

E. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

F. Research/Evaluation Reports: Evidence of steel joists' compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing joists similar to those indicated for this Project and with a record of successful in-service performance.

1. Manufacturer must be certified by SJI to manufacture joists complying with SJI standard specifications and load tables.
2. Assumes responsibility for engineering special joists to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
3. Professional Engineer Qualifications: A professional engineer who is legally authorized to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of joists that are similar to those indicated for this Project in material, design, and extent.

B. SJI Specifications: Comply with SJI's "Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders" (hereafter, "Specifications"), applicable to types of joists indicated.

C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel"; and AWS D1.3 "Structural Welding Code--Sheet Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle joists as recommended in SJI's "Specifications."

B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

1.8 SEQUENCING

A. Deliver steel bearing plates and other devices to be built into concrete and masonry construction.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel: Comply with SJI's "Specifications" for chord and web members.

B. Steel Bearing Plates: ASTM A 36/A 36M.

C. Carbon-Steel Bolts and Threaded Fasteners: ASTM A 307, Grade A, carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.

1. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C.

D. Welding Electrodes: Comply with AWS standards.

E. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035.

2.2 PRIMERS

A. Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer with good resistance to normal atmospheric corrosion, complying with performance requirements in FS TT-P-664.

2.3 OPEN-WEB K-SERIES STEEL JOISTS

A. Manufacture steel joists according to "Standard Specifications for Open Web Steel Joists, K-Series," in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord; of joist type indicated.

1. Joist Type: K and KCS-series steel joists.

B. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.

C. Provide holes in chord members for connecting and securing other construction to joists.

D. Top-Chord Extensions: Extend top chords of joists with SJI's Type S top-chord extensions where indicated, complying with SJI's "Specifications."

E. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated, complying with SJI's "Specifications."

F. Camber joists according to SJI's "Specifications", as required.

G. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.5 JOIST ACCESSORIES

A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span.

B. Bridging: Schematically indicated. Detail and fabricate according to SJI's "Specifications."

C. Bridging: Fabricate as indicated and according to SJI's "Specifications."

1. Furnish additional erection bridging if required.

D. Fabricate steel bearing plates with integral anchorages of sizes and thicknesses indicated. Hot-dip zinc coat according to ASTM A 123/A 123M.

E. Steel bearing plates with integral anchorages are specified in Division 5 Section "Metal Fabrications."

F. Supply ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch of finished wall surface, unless otherwise indicated.

G. Supply miscellaneous accessories, including splice plates and bolts required by joist manufacturer to complete joist installation.

2.6 CLEANING AND SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories to be primed by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.

B. Do not prime paint joists and accessories to receive sprayed fire-resistive materials].

C. Apply one shop coat of primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil thick.

D. Painting of joists and joist accessories is specified in Division 9 Section "Painting."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates, embedded bearing plates, and abutting structural framing, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Do not install joists until supporting construction is in place and secured.

B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written recommendations, and requirements in this Section.

1. Before installation, splice joists delivered to Project site in more than one piece.
2. Space, adjust, and align joists accurately in location before permanently fastening.
3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads have been applied.

C. Field weld joists to supporting steel bearing plates. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

D. Bolt joists to supporting steel framework using carbon-steel bolts, unless otherwise indicated.

E. Bolt joists to supporting steel framework using high-strength structural bolts, unless otherwise indicated. Comply with RCSC's "Allowable Stress Design Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts" for high-strength structural bolt installation and tightening requirements.

F. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner shall employ and pay for a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Field welds will be visually inspected according to AWS D1.1.

C. In addition to visual inspection, field welds will be tested according to AWS D1.1 and the following procedures, as applicable:

1. Magnetic Particle Inspection: ASTM E 709.
2. Liquid Penetrant Inspection: ASTM E 165.

D. Bolted connections will be visually inspected.

1. High-strength, field-bolted connections will be tested and verified according to procedures in RCSC's "Allowable Stress Design Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts."

E. Correct deficiencies in Work that inspections and test reports have indicated are not in compliance with specified requirements.

F. Additional testing will be performed to determine compliance of corrected Work with specified requirements.

3.4 REPAIRS AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories, bearing plates and abutting structural steel.

1. Clean and prepare surfaces by hand-tool cleaning, SSPC-SP 2, or power-tool cleaning, SSPC-SP 3.
2. Apply a compatible primer of the same type as the shop primer used on adjacent surfaces.

C. Touchup Painting: Cleaning and touchup painting are specified in Division 9 Section "Painting."

D. Provide final protection and maintain conditions, in a manner acceptable to manufacturer, Installer and Engineer that ensure joists and accessories are without damage or deterioration at time of Substantial Completion.

END OF SECTION 05210

SECTION 05310 - STEEL DECK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Roof deck when indicated.

1.3 SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, deck openings, special jointing, accessories, and attachments to other construction.

C. Product Certificates: Signed by steel deck manufacturers certifying that products furnished comply with requirements.

D. Welding Certificates: Copies of certificates for welding procedures and personnel.

E. Product Test Reports: From a qualified testing agency indicating that each of the following complies with requirements, based on comprehensive testing of current products:

1. Mechanical fasteners.
2. Acoustical roof deck.

F. Research/Evaluation Reports: Evidence of steel deck's compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed steel deck similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

D. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those steel deck units tested for fire resistance per ASTM E 119 by a testing and inspection agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.

E. AISI Specifications: Calculate structural characteristics of steel deck according to AISI's "Specification for the Design of Cold-Formed Steel Structural Members."

F. FM Listing: Provide steel roof deck evaluated by FM and listed in FM's "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

1.6 COORDINATION

A. Coordinate installation of sound-absorbing insulation strips in topside ribs of acoustical deck with roofing installation specified in Division 7 to ensure protection of insulation strips against damage from effects of weather and other causes.

B. Coordinate layout and installation of trench headers, preset inserts, duct fittings, and other components specified in Division 16 Section "Underfloor Raceway" with installation of cellular metal floor deck.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

1. Steel Deck:

a. BHP Steel Building Products USA Inc.
b. Consolidated Systems, Inc.

c. Epic Metals Corp.
d. Marlyn Steel Products, Inc.
e. Nucor Corp.; Vulcraft Div.
f. Roof Deck, Inc.
g. United Steel Deck, Inc.
h. Verco Manufacturing Co.
i. Wheeling Corrugating Co.; Div. of Wheeling-Pittsburgh Steel Corp.

2.2 ROOF DECK

A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 29, and the following:
1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G60 zinc coating.
2. Deck Profile: As Indicated.
3. Profile Depth: As indicated.
4. Design Uncoated-Steel Thickness: As indicated.
5. Design Uncoated-Steel Thicknesses; Deck Unit/Bottom Plate: As indicated.
6. Span Condition: As indicated.
7. Side Laps: As indicated.

2.3 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Steel Sheet Accessories: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.

G. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 29 for overhang and slab depth.

H. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.

I. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.

J. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, .0598 inch thick, with factory-punched hole of 3/8-inch minimum diameter.

K. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3-inch- wide flanges and recessed pans of 1-1/2- inch minimum depth. For drains, cut holes in the field.

L. Flat Sump Plate: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.

M. Shear Connectors: ASTM A 108, Grades 1010 through 1020 headed stud type, cold-finished carbon steel, AWS D1.1, Type B, with arc shields.

N. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.

O. Repair Paint: Lead- and chromate-free rust-inhibitive primer complying with performance requirements of FS TT-P-664.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 29, manufacturer's written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.

C. Locate decking bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

1. Align cellular deck panels for entire length of cell runs and align cells at ends of abutting panels.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to decking.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of decking, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF DECK INSTALLATION

A. Fasten roof deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter, but not less than 1-1/2 inches long, and as follows:

1. Weld Diameter: 5/8 inch nominal.
2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds as indicated.
3. Weld Washers: Install weld washers at each weld location.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports as indicated, and as follows

1. Mechanically fasten with self-drilling No. 10 diameter or larger carbon-steel screws.
2. Mechanically clinch or button punch.
3. Fasten with a minimum of 1-1/2-inch- long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:

1. End Joints: Lapped 2 inches minimum

D. Roof Sump Pans and Sump Plates: Install over openings provided in roof decking and weld flanges to top of deck. Space welds not more than 12 inches apart with at least 1 weld at each corner.

E. Miscellaneous Roof Deck Accessories: Install ridge and valley plates, finish strips, cover plates, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.

F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

G. Sound-Absorbing Insulation: Installation into topside ribs of deck as specified in Division 7 .

3.4 FIELD QUALITY CONTROL

A. Testing: Owner shall employ and pay for a qualified independent testing agency to perform field quality-control testing.

B. Field welds will be subject to inspection.

C. Shear connector stud welds will be inspected and tested according to AWS D1.1 for stud welding and as follows:

1. Shear connector stud welds will be visually inspected.
2. Bend tests will be performed if visual inspections reveal less than a full 360-degree flash or welding repairs to any shear connector stud.
3. Tests will be conducted on additional shear connector studs if weld fracture occurs on shear connector studs already tested according to AWS D1.1.

D. Testing agency will report test results promptly and in writing to Contractor and Architect.

E. Remove and replace work that does not comply with specified requirements.

F. Additional testing and inspecting will be performed to determine compliance of corrected work with specified requirements. Contractor will reimburse Owner for the costs of these additional tests.

3.5 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05310

SECTION 05400 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Interior non-load-bearing wall framing.
2. Exterior load-bearing wall framing.
3. Exterior non-load-bearing wall framing.

1.3 DEFINITIONS

A. Minimum Base Steel Thickness: Minimum base thickness of cold-formed framing delivered to the Project site shall be not less than 95 percent of the thickness used in the cold- formed framing design. Lesser thicknesses shall be permitted at bends due to cold forming.

B. Producer: Entity that produces steel sheet coil fabricated into cold-formed members.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.

1. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
   a. Interior Non-Load-Bearing Wall Framing: Horizontal deflection of 1/360 of the wall height under a horizontal load of 5 lbf/sq. ft.
   b. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/600 of the wall height for backing brick veneer and 1/360 of the wall height for backing others.
   c. Ceiling Joist Framing: Vertical deflection of 1/360 of the span.

2. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg. F.
3. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:

   a. Upward and downward movement of 1/2 inch.

B. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions." and AISI S240.

1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing - Header Design."
2. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

1.5 SUBMITTALS

A. Product Data: For each type of cold-formed metal framing product and accessory indicated.

B. Shop Drawings: Provide Shop Drawings prepared by cold-formed metal framing manufacturer. Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

1. For cold-formed metal framing indicated to comply with design loads, include structural Analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Mill certificates by steel sheet producer or test reports from a qualified independent testing agency indicating steel sheet complies with requirements.

D. Welding Certificates: Copies of certificates for welding procedures and personnel.

E. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

F. Product Test Reports: From a qualified testing agency indicating that each of the following complies with requirements, based on comprehensive testing of current products:

1. Expansion anchors.

2. Steel Sheet.
3. Power-actuated anchors.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Miscellaneous structural clips and accessories.

G. Research/Evaluation Reports: Evidence of cold-formed metal framing's compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Member in good standing of the Steel Framing Industry Association (SFIA) or be a part of a similar organization that provides verifiable code compliance program.

1. Products to be certified under an independent third-party inspection program administered by an agency accredited by IAS to ICC-ES AC98 IAS Accreditation Criteria for Inspection Agencies.

B. Installer Qualifications: An experienced installer who has completed cold-formed metal framing similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Engineering Responsibility: Engage a qualified professional engineer to prepare design calculations, Shop Drawings, and other structural data.

D. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.

E. Product Tests: Mill certificates by steel sheet producer or test reports from a qualified independent testing agency [, or in-house testing with calibrated test equipment,] indicating steel sheet complies with requirements, including base steel thickness, yield strength, tensile strength, total elongation, chemical requirements, ductility, and metallic-coating thickness.

F. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated.

G. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified in accordance with the product-certification program of the Steel Framing Industry Association (SFIA) or be a part of a similar organization that provides verifiable code compliance program.

H. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

I. Fire-Test-Response Characteristics: Where metal framing is part of a fire-resistance-rated assembly, provide framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

J. Fire-Resistance Ratings: Indicated by GA File Numbers in GA-600, "Fire Resistance Design Manual," or by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.

K. Comply with AISI's S100 "Specification for the Design of Cold-Formed Steel Structural Members" for calculating structural characteristics of cold-formed metal framing, and AISI S240.

L. Comply with HUD's "Prescriptive Method for Residential Cold-Formed Steel Framing."

M. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide cold-formed metal framing by one of the following or approved equal:

1. The Steel Network, Inc.
2. ClarkDietrich.
3. AllSteel Products, Inc.
4. MarinoWare; Div. of Ware Industries, Inc.
5. United Metal Products, Inc.
6. Steel Construction Systems.
7. Or Approved equal.

2.2 MATERIALS

A. Framing Members, General: Comply with AISI S200 and ASTM C955, Section 8 for conditions indicated.

B. Steel Sheet: ASTM A1003/A1003M; A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: 33 minimum or as required by structural performance.
2. Coating: [CP 60: G60 (Z180), A60 (ZF180), AZ50 (AZM150), or GF30 (ZGF90)] [CP 90: G90 (Z275), AZ50 (AZM150), or GF45 (ZGF135)]

C. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, complying with AISI S240 and as follows:

1. Minimum Uncoated-Steel Thickness: Matching steel studs.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads, and as follows:.

1. Minimum Base-Steel Thickness: Matching steel studs.
2. Flange Width: Manufacturer's standard deep flange width

E. Vertical Deflection Clips: Manufacturer's standard clips, capable of accommodating upward and downward vertical displacement of primary structure.

2.3 EXTERIOR AND INTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
1. Minimum Base Steel Thickness: 0.0428 inch
2. Flange Width: 1-5/8 inches

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
1. Minimum Base Steel Thickness 0.0428 inch
2. Flange Width: 1-1/4 inches

C. Vertical Deflection Clips: Manufacturer's standard head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
   a. ClarkDietrich.
   b. MarinoWare, a division of Ware Industries.
   c. SCAFCO Corporation
   d. The Steel Network, Inc.
   e. Or approved equal

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
   a. ClarkDietrich.
   b. MarinoWare, a division of Ware Industries.
   c. SCAFCO Corporation
   d. The Steel Network, Inc.
   e. Or approved equal
2. Minimum Base Steel Thickness: 0.0428
3. Flange Width: 1 inch plus the design gap for 1-story structures

E. Slotted Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; punched with vertical slots in both legs. Studs should be positively attached to deep-leg track using vertical slots while allowing free vertical movement. Legs designed to support horizontal and lateral loads and transfer them to the primary structure, as follows:
   1. ClarkDietrich; MaxTrak Slotted Deflection Track or approved equal.
   2. Leg Dimension: 2-1/2 inches with 1-1/2-inch slot
   3. Minimum Thickness:[0.0428 inch

F. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
   1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:
      a. Minimum Base Steel Thickness: 0.0428 inch
      b. Flange Width: 1 inch plus the design gap for 1-story structures
   2. Inner Track: Of web depth indicated, and as follows:
      a. Minimum Base Steel Thickness: 0.0428 inch
      b. Flange Width: Equal to sum of outer deflection track flange width plus 1 inch

G. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.
   1. ClarkDietrich; Drift FastClip Slide Clip (D-FCSC) or approved equal
   2. Minimum Base-Steel Thickness: 0.0677 inch

2.4 SOFFIT FRAMING

A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:

   1. Minimum Base-Steel Thickness: 0.0329 inch.
   2. Flange Width: 1-5/8 inches.

2.5 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
   1. Supplementary framing.
   2. Bracing, bridging, and solid blocking.
      a. ClarkDietrich; Spazzer 5400 Bridging Bar (SPZS) or approved equal.
   3. Web stiffeners.
      a. ClarkDietrich; Quick Twist Web Stiffener (QTWS) or approved equal.
   4. Anchor clips.
      a. ClarkDietrich; Moment Clip (MC Series) or approved equal.

5. End clips.
6. Foundation clips.
   a. ClarkDietrich; Pony Wall PW48 or approved equal.
7. Gusset plates.
8. Stud kickers, knee braces, and girts.
9. Joist hangers and end closures.
   a. ClarkDietrich; Universal Joist Hanger (UJH) or approved equal.
10. Hole reinforcing plates.
11. Backer plates.

2.6 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTMA 123.

B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

E. Mechanical Fasteners: Corrosion-resistant-coated, self-drilling, self-threading steel drill screws.
   1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.7 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035B,

B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.

D. Shims: Load bearing, high-density multimonomer plastic, nonleaching.

E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.8 FABRICATION

A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to manufacturer's written recommendations and requirements in this Section.
   1. Fabricate framing assemblies using jigs or templates.
   2. Cut framing members by sawing or shearing; do not torch cut.
   3. Fasten cold-formed metal framing members by welding. Wire tying of framing members is not permitted. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
   4. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.
      a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
      b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
   5. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

   1. Product: ClarkDietrich; Panel Lift Clip (PLC) or comparable product.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
   1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
   2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

C. Grout bearing surfaces uniform and level to ensure full contact of bearing flanges or track webs on supporting concrete or masonry construction.

D. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. A Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed metal framing according to ASTM C 1007, AISI S240, and manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
   1. Bolt or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to manufacturer's written recommendations and requirements in this Section.
   1. Cut framing members by sawing or shearing; do not torch cut.
   2. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.
      a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
      b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.

E. Install framing members in one-piece lengths, unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

H. Install insulation in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

J. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
   1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 LOAD-BEARING WALL INSTALLATION

A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:

   1. Anchor Spacing: 24 inches (610 mm).

B. Squarely seat studs against top and bottom tracks, with gap not exceeding 1/8 inch (3 mm) between the end of wall-framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:

   1. Stud Spacing: 16 inches.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.

D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.

E. Align floor and roof framing over studs in accordance with AISI S200, Section C1. Where framing cannot be aligned, continuously reinforce track to transfer loads.

F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure.

G. Install headers over wall openings wider than stud spacing. Locate headers above openings. Fabricate headers of compound shapes or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.

   1. Frame wall openings with not less than a double stud at each jamb of frame. Fasten jamb members together to uniformly distribute loads. A single proprietary jamb member designed specifically for the purpose of supporting the header may be used in lieu of multiple members.
   2. Install tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.

H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.

1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.

I. Install horizontal bridging in stud system, spaced vertically 48 inches.

1. Channel Bridging: Cold-formed steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle for framing members up to 6 inches deep.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges, and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed in accordance with manufacturer's written instructions.

J. Install steel sheet diagonal bracing straps to both stud flanges; terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.

K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 EXTERIOR AND INTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:
1. Stud Spacing: 16 inches (Unless noted otherwise)

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
1. Install single-leg deflection tracks and anchor to building structure.
2. Install double deep-leg deflection tracks and anchor outer track to building structure.
3. Connect vertical deflection clips to bypassing studs and anchor to building structure.
4. Connect drift clips to cold formed metal framing and anchor to building structure.

E. Install horizontal bridging in curtain-wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or stud-track solid blocking of width and

thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.

a. Install solid blocking at 96-inch centers or as indicated on Shop Drawings.

2. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
3. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
4. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable curtain-wall-framing system.

3.6 GYPSUM SHEATHING INSTALLATION

A. General: Install gypsum sheathing to comply with GA-253 and manufacturer's written instructions.

B. Cut boards at penetrations, edges, and other obstructions of the work; fit tightly against abutting construction, except provide a 3/8-inch setback where non-load-bearing construction abuts structural elements.

C. Coordinate sheathing installation with flashing and joint sealant installation so these materials are installed in the sequence and manner that prevent exterior moisture from passing through completed exterior wall assembly.

D. Apply fasteners so screw heads bear tightly against face of sheathing boards but do not cut into facing.

E. Do not bridge building expansion joints with sheathing; cut and space edges to match spacing of structural support elements.

F. Horizontal Installation: Install 24-inch- wide gypsum sheathing boards horizontally with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent boards without forcing. Abut ends of boards over centers of stud flanges and stagger end joints of adjacent boards not less than one stud spacing. Screw-attach boards at perimeter and within field of board to each steel stud at approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.

G. Vertical Installation: Install 48-inch wide gypsum sheathing boards vertically with vertical edges centered over flanges of steel studs. Abut ends and edges of each board with those of adjacent boards. Screw-attach boards at perimeter and within field of board to each steel stud at approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.

H. Air-Infiltration Barrier Application: Cover sheathing with air-infiltration barrier as follows:

1. Cut back air-infiltration barrier 1/2 inch on each side of break in supporting members at expansion- or control-joint locations.
2. Apply asphalt-saturated organic felt horizontally with 2-inch overlap and 6-inch end lap; fasten to sheathing with corrosion-resistant staples.
3. Apply proprietary building wrap to comply with manufacturer's written installation instructions.
4. Apply air-infiltration barrier to cover vertical flashing with 4-inch overlap.

I. Sealing Sheathing Joints: Seal joints according to sheathing manufacturer's written recommendations and as follows:
1. Apply elastomeric sealant on joints and fasteners and trowel flat. Apply sufficient quantity of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing board joints, and apply and trowel silicone emulsion sealant to embed sealant in entire face of tape. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

3.7 FIELD QUALITY CONTROL

A. Testing: Owner will employ and pay for a qualified independent testing agency to perform field quality-control testing.

B. Field and shop welds will be subject to inspection and testing.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace Work that does not comply with specified requirements.

E. Additional testing and inspecting will be performed to determine compliance of corrected Work with specified requirements. Contractor will reimburse Owner for the costs of these additional tests.

3.8 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: Wire brush, clean, and paint scarred areas, welds, and rust spots on fabricated and installed prime-painted, cold-formed metal framing. Paint framing surfaces with same type of shop paint used on adjacent surfaces.

C. Protect paper-surfaced gypsum sheathing that will be exposed to weather for more than 30 days by covering exposed exterior surface of sheathing with a securely fastened air-infiltration barrier. Apply covering immediately after sheathing is installed.

D. Protect cutouts, corners, and joints in sheathing by filling with a flexible sealant or by applying tape recommended by sheathing manufacturer at time sheathing is applied.

END OF SECTION 05400

SECTION 05500 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Loose steel lintels.
   2. Steel framing and supports for mechanical equipment.

1.3 SUBMITTALS

A. Product Data: For the following:
   1. Paint products.
   2. Grout.
   3. Hardware

B. Shop Drawings: Detail fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing metal fabrications similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

B. Welding: Qualify procedures and personnel according to the following:

   1. AWS D1.1, "Structural Welding Code--Steel."
   2. AWS D1.3, "Structural Welding Code--Sheet Steel."

1.5 PROJECT CONDITIONS

A. Field Measurements: Where metal fabrications are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Allow for trimming and fitting.

1.6 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304.

C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.

D. Steel Tubing: Cold-formed steel tubing complying with ASTM A 500.

E. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

F. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

2.3 PAINT

A. Shop Primers: Provide primers that comply with Division 9 Section "Painting."

B. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664; selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

C. Shop Primer for Ferrous Metal: Organic zinc-rich primer, complying with SSPC-Paint 20 and compatible with topcoat.

D. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

2.4 FASTENERS

A. General: Provide Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls. Select fasteners for type, grade, and class required.

B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

1. Material: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material: Alloy Group 1 or 2 stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594.

2.5 GROUT

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.6 CONCRETE FILL

A. Concrete Materials and Properties: Normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

2.7 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Shear and punch metals cleanly and accurately. Remove burrs.

C. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

E. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

F. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

G. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

H. Allow for thermal movement resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening up of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

I. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

J. Remove sharp or rough areas on exposed traffic surfaces.

K. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

2.8 LOOSE STEEL LINTELS

A. Fabricate loose structural-steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.

B. Weld adjoining members together to form a single unit where indicated.

C. Size loose lintels to provide bearing length at each side of openings equal to one-twelfth of clear span, but not less than 8 inches, unless otherwise indicated.

D. Galvanize loose steel lintels located in exterior walls.

2.9 SHELF ANGLES AND WELDED STEEL BOX CHASES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete. Align expansion joints in angles with indicated control and expansion joints in cavity-wall exterior wythe.

C. Galvanize shelf angles to be installed in exterior walls.

D. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.10 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports that are not a part of structural-steel framework as necessary to complete the Work.

B. General: Provide steel framing and supports indicated and as necessary to complete the Work.

C. Fabricate units from structural-steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

D. Galvanize miscellaneous framing and supports where indicated.

2.11 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.12 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:

1. ASTM A 123, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless

otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

E. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings, if any.

1. Support steel beams on solid grouted masonry, concrete, or on existing structural steel.

3.3 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 Section "Painting."

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05500

SECTION 05521 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following as indicated on the drawings:

1. Stainless-steel pipe and tube handrails and railings.
2. Steel pipe and tube handrails and railings.

1.3 PERFORMANCE REQUIREMENTS

A. General: In engineering handrails and railings to withstand structural loads indicated, determine allowable design working stresses of handrail and railing materials based on the following:

1. Stainless Steel: ASCE 8, "Specification for the Design of Cold-Formed Stainless Steel Structural Members."
2. Structural Steel: AISC S335, "Specification for Structural Steel Buildings Allowable Stress Design and Plastic Design with Commentary."
3. Cold-Formed Structural Steel: AISI SG-673, Part I, "Specification for the Design of Cold-Formed Steel Structural Members."

B. Structural Performance of Handrails and Railings: Provide handrails and railings complying with requirements of ASTM E 985 for structural performance, based on testing performed according to ASTM E 894 and ASTM E 935.

C. Structural Performance of Handrails and Railings: Provide handrails and railings capable of withstanding the following structural loads without exceeding allowable design working stresses of materials for handrails, railings, anchors, and connections:

1. Top Rail of Guards: Capable of withstanding the following loads applied as indicated:

a. Concentrated load of 200 lbf applied at any point and in any direction.
b. Uniform load of 50 lbf/ft. applied horizontally and concurrently with uniform load of 100 lbf/ft. applied vertically downward.
c. Concentrated and uniform loads above need not be assumed to act concurrently.

2. Handrails Not Serving As Top Rails: Capable of withstanding the following loads applied as indicated:

a. Concentrated load of 200 lbf applied at any point and in any direction.
b. Uniform load of 50 lbf/ft. applied in any direction.
c. Concentrated and uniform loads above need not be assumed to act concurrently.

3. Infill Area of Guards: Capable of withstanding a horizontal concentrated load of 200 lbf applied to 1 sq. ft. at any point in system, including panels, intermediate rails, balusters, or other elements composing infill area.

    a. Load above need not be assumed to act concurrently with loads on top rails in determining stress on guard.

D. Thermal Movements: Provide handrails and railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

E. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Manufacturer's product lines of mechanically connected handrails and railings.
2. Grout, anchoring cement, and paint products.

B. Shop Drawings: Show fabrication and installation of handrails and railings. Include plans, elevations, sections, component details, and attachments to other Work.

1. Provide structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation for all handrails and railings compliant with the current Code (IBC 2018 NJ Edition).

C. Samples for Initial Selection: Short sections of railing or flat, sheet metal samples showing available mechanical finishes.

D. Provide samples as requested by the Owner for each type of railing, handrails and handrail brackets to the post.

E. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

F. Product Test Reports: From a qualified testing agency indicating handrails and railings comply with ASTM E 985, based on comprehensive testing of current products.

1.5 QUALITY ASSURANCE

A. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in New Jersey and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of

handrails and railings that are similar to those indicated for this Project in material, design, and extent.

B. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

C. Source Limitations: Obtain each type of handrail and railing through one source from a single manufacturer.

1.6 STORAGE

A. Store handrails and railings in a dry, well-ventilated, weathertight place.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify handrail and railing dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating handrails and railings without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

A. Coordinate installation of anchorages for handrails and railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.9 SCHEDULING

A. Schedule installation so handrails and railings are mounted only on completed walls. Do not support temporarily by any means that does not satisfy structural performance requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following or approved equal:

1. Steel and Stainless-Steel Pipe and Tube Railings:

a. High Point Architectural Metal.
b. Architectural Art Mfg., Inc.
c. Blum: Julius Blum & Co., Inc.
d. Approved equal.

2.2 METALS

A. General: Provide metal free from pitting, seam marks, roller marks, stains, discolorations, and other imperfections where exposed to view on finished units.

B. Stainless Steel: Grade or type designated below for each form required: Provide all pipes, tubing, castings and plate stainless steel from type 304 stainless for interior railings and type 316 for exterior railings.

C. Steel and Iron: Provide steel and iron in the form indicated, complying with the following requirements:

1. Steel Pipe: ASTM A 53; finish, type, and weight class as follows:

    a. Black finish, unless otherwise indicated.
    b. Galvanized finish for exterior installations and where indicated.
    c. Type F, or Type S, Grade A, standard weight (Schedule 40), unless another grade and weight are required by structural loads.

2. Steel Tubing: Cold-formed steel tubing, ASTM A 500, Grade A, unless another grade is required by structural loads.
3. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
4. Iron Castings: Malleable iron complying with ASTM A 47, Grade 32510.
5. Iron Castings: Gray iron complying with ASTM A 48, Class 30.

D. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

2.3 WELDING MATERIALS, FASTENERS, AND ANCHORS

A. Welding Electrodes and Filler Metal: Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

B. Fasteners for Anchoring Handrails and Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring handrails and railings to other types of construction indicated and capable of withstanding design loads.

1. For stainless-steel handrails and railings, use fasteners fabricated from Type 304 stainless steel for interior work and Type 316 stainless steel for exterior work.
2. For steel handrails, railings, and fittings, use plated fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.

C. Fasteners for Interconnecting Handrail and Railing Components: Use fasteners fabricated from same basic metal as fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.

1. Provide concealed fasteners for interconnecting handrail and railing components and for attaching them to other work, unless otherwise indicated.

2. Provide Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.

D. Cast-in-Place and Postinstalled Anchors: Anchors of type indicated below, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

1. Cast-in-place anchors.
2. Chemical anchors.
3. Expansion anchors.

2.4 PAINT

A. Shop Primers: Provide primers to comply with applicable requirements in Division 9 Section "Painting."

B. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664; selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

C. Shop Primer for Galvanized Steel: Zinc-dust, zinc-oxide primer formulated for priming zinc-coated steel and for compatibility with finish paint systems indicated, and complying with SSPC-Paint 5.

2.5 GROUT AND ANCHORING CEMENT

A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

B. Interior Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Use for interior applications only.

C. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.6 FABRICATION

A. General: Fabricate handrails and railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Assemble handrails and railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Form changes in direction of railing members as follows:

1. As detailed.
2. By bending.
3. By radius bends of radius indicated.
4. By flush radius bends.
5. By mitering at elbow bends.
6. By inserting prefabricated flush-elbow fittings.
7. By any method indicated above as detailed in the drawings, applicable to change in direction involved.

D. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.

E. Welded Connections: Fabricate handrails and railings for connecting members by welding. Cope components at perpendicular and skew connections to provide close fit, or use fittings designed for this purpose. Weld connections continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

F. Nonwelded Connections: Fabricate handrails and railings by connecting members with concealed mechanical fasteners and fittings, unless otherwise indicated. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

1. Fabricate splice joints for field connection using an epoxy structural adhesive where this is manufacturer's standard splicing method.

G. Welded Connections for Aluminum Pipe: Fabricate pipe handrails and railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.

H. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect handrail and railing members to other work, unless otherwise indicated.

I. Provide inserts and other anchorage devices for connecting handrails and railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads

imposed by handrails and railings. Coordinate anchorage devices with supporting structure.

J. For railing posts set in concrete, provide preset sleeves of steel not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, and steel plate forming bottom closure.

K. For removable railing posts, fabricate slip-fit sockets from steel tube whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height. Provide socket covers designed and fabricated to resist being dislodged.

1. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.

L. Shear and punch metals cleanly and accurately. Remove burrs from exposed cut edges.

M. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work.

N. Cut, reinforce, drill, and tap components, as indicated, to receive finish hardware, screws, and similar items.

O. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members that are exposed to exterior or to moisture from condensation or other sources.

P. Fabricate joints that will be exposed to weather in a watertight manner.

Q. Close exposed ends of handrail and railing members with prefabricated end fittings.

R. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns, unless clearance between end of railing and wall is 1/4 inch or less.

S. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

T. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.7 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Provide exposed fasteners with finish matching appearance, including color and texture, of handrails and railings.

2.8 STAINLESS-STEEL FINISHES

A. Remove or blend tool and die marks and stretch lines into finish.

B. Grind and polish surfaces to produce uniform, directionally textured polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

C. 180-Grit Polished Finish: Oil-ground, uniform, textured finish.

D. 320-Grit Polished Finish: Oil-ground, uniform, smooth finish.

E. Polished and Buffed Finish: Oil-ground, 180-grit finish followed by buffing.

F. Bright, Directional Polish: No. 4 finish.

G. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.9 STEEL FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:

1. ASTM A 123, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

B. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

C. For galvanized handrails and railings, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

D. For nongalvanized steel handrails and railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors to be embedded in exterior concrete or masonry.

E. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed handrails and railings:

1. Exteriors (SSPC Zone 1B): SSPC-SP 6, "Commercial Blast Cleaning."

2. Interiors (SSPC Zone 1A): SSPC-SP 7, "Brush-off Blast Cleaning."

F. Apply shop primer to prepared surfaces of handrail and railing components, unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

1. Do not apply primer to galvanized surfaces.
2. Stripe paint edges, corners, crevices, bolts, and welds.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required to install handrails and railings. Set handrails and railings accurately in location, alignment, and elevation; measured from established lines and levels and free from rack.

1. Do not weld, cut, or abrade surfaces of handrail and railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

C. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

D. Adjust handrails and railings before anchoring to ensure matching alignment at abutting joints. Space posts at interval indicated, but not less than that required by structural loads.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing handrails and railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members

and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of handrails and railings.

B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

3.4 ANCHORING POSTS

A. Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with the following anchoring material, mixed and placed to comply with anchoring material manufacturer's written instructions:

B. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with the following anchoring material, mixed and placed to comply with anchoring material manufacturer's written instructions:

1. Nonshrink, nonmetallic grout.
2. Nonshrink, nonmetallic grout or anchoring cement.

C. Cover anchorage joint with flange of same metal as post, attached to post as follows:

1. Welded to post after placing anchoring material.
2. By set screws.

D. Leave anchorage joint exposed; wipe off surplus anchoring material; and leave 1/8-inch build-up, sloped away from post.

E. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:

1. For stainless-steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.
2. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.

F. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

3.5 ANCHORING RAILING ENDS

A. Anchor railing ends into concrete and masonry with round flanges connected to railing ends and anchored into wall construction with postinstalled anchors and bolts.

B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces.

1. Weld flanges to railing ends.
2. Connect flanges to railing ends using nonwelded connections.

3.6 ATTACHING HANDRAILS TO WALLS

A. Attach handrails to wall with manufactured machined wall brackets. Provide bracket with 1-1/2-inch clearance from inside face of handrail and finished wall surface.

B. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

C. Secure wall brackets to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.
3. For wood stud partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with carpentry work to locate backing members.
4. For steel-framed gypsum board assemblies, use hanger or lag bolts set into wood backing between studs. Coordinate with stud installation to locate backing members.
5. For steel-framed gypsum board assemblies, fasten brackets directly to steel framing or concealed reinforcements using self-tapping screws of size and type required to support structural loads.

3.7 CLEANING

A. Clean aluminum and stainless steel by washing thoroughly with clean water and soap and rinsing with clean water.

B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material.

C. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 Section "Painting."

D. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.8 PROTECTION

A. Protect finishes of handrails and railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at the time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 05521

SECTION 06100 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Framing with dimension lumber.
2. Framing with engineered wood products.
3. Wood furring, grounds, nailers, and blocking.
4. Sheathing.
5. Subflooring.

1.3 DEFINITIONS

A. Rough Carpentry: Carpentry work not specified in other Sections and not exposed, unless otherwise specified.

B. Exposed Framing: Dimension lumber not concealed by other construction and indicated to receive a stained or natural finish.

1.4 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for the following products:

1. Engineered wood products.
2. Underlayment.
3. Insulating sheathing.
4. Air-infiltration barriers.

C. Material certificates for dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the American Lumber Standards Committee's (ALSC) Board of Review.

D. Wood treatment data as follows, including chemical treatment manufacturer's instructions for handling, storing, installing, and finishing treated materials:

1. For each type of preservative-treated wood product, include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: To qualify for approval, an independent testing agency must demonstrate to Architect's satisfaction, based on evaluation of agency-submitted criteria conforming to ASTM E 699, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.

B. Single-Source Responsibility for Engineered Wood Products: Obtain each type of engineered wood product from one source and by a single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Keep materials under cover and dry. Protect from weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels. Provide for air circulation within and around stacks and under temporary coverings.

1. For lumber and plywood pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following or approved equal:

1. Wood-Preservative-Treated Materials:
   a. Baxter: J. H. Baxter Co.
   b. Chemical Specialties, Inc.
   c. Continental Wood Preservers, Inc.
   d. Osmose Wood Preserving, Inc.
   e. or approved equal

2. Laminated-Veneer Lumber:
   a. Alpine Structures.
   b. Georgia-Pacific Corp.
   c. Trus Joist MacMillan.
   d. or approved equal

3. Prefabricated Wood I-Joists:
   a. Trus Joist MacMillan.
   b. Alpine Structures.
   c. Georgia-Pacific Corp.

d. or approved equal

4. Gypsum Sheathing Board:
   a. Georgia-Pacific Corp.
   b. National Gypsum Co.; Gold Bond Building Products Division.
   c. United States Gypsum Co.
   d. or approved equal

5. Air-Infiltration Barriers:
   a. Celotex Corporation (The); Building Products Division.
   b. DuPont Company; Fibers Department.
   c. or approved equal

2.2 LUMBER, GENERAL

A. Lumber Standards: Comply with DOC PS 20, "American Softwood Lumber Standard," and with applicable grading rules of inspection agencies certified by ALSC's Board of Review.

B. Inspection Agencies: Inspection agencies, and the abbreviations used to reference them, include the following:

1. NELMA - Northeastern Lumber Manufacturers Association.
2. NLGA - National Lumber Grades Authority (Canadian).
3. RIS - Redwood Inspection Service.
4. SPIB - Southern Pine Inspection Bureau.
5. WCLIB - West Coast Lumber Inspection Bureau.
6. WWPA - Western Wood Products Association.

C. Grade Stamps: Provide lumber with each piece factory marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.

D. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.

1. Provide dressed lumber, S4S, unless otherwise indicated.
2. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal (38-mm actual) thickness or less, unless otherwise indicated.

2.3 WOOD-PRESERVATIVE-TREATED MATERIALS

A. General: Where lumber or plywood is indicated as preservative treated or is specified to be treated, comply with applicable requirements of AWPA C2 (lumber) and AWPA C9 (plywood). Mark each treated item with the Quality Mark Requirements of an inspection agency approved by ALSC's Board of Review.

B. Pressure treat wood members in contact with ground or freshwater with waterborne preservatives to a minimum retention of 0.40 lb/cu. ft. (6.4 kg/cu. m).

C. All preservative treated materials should all be secured by stainless steel screws or fasteners with isolated material to all metal members.

2.4 DIMENSION LUMBER

A. General: Provide dimension lumber of grades indicated according to the ALSC National Grading Rule (NGR) provisions of the inspection agency indicated.

B. Non-Load-Bearing Interior Partitions: Provide framing of the following grade and species:

1. Grade: No. 2.
2. Species: Eastern softwoods; NELMA.
3. Species: Northern species; NLGA.
4. Species: Mixed southern pine; SPIB.
5. Species: Western woods; WCLIB or WWPA.
6. Species: Any species above.

C. Exterior and Load-Bearing Walls: Provide framing of the following grade and species:

D. Framing Other than Non-Load-Bearing Partitions: Provide framing of the following grade and species:

1. Grade: No. 2.
2. Species: Spruce-pine-fir south; NELMA.
3. Species: Hem-fir north; NLGA.
4. Species: Spruce-pine-fir north; NLGA.
5. Species: Mixed southern pine; SPIB.
6. Species: Hem-fir; WCLIB or WWPA.
7. Species: Any species above.

2.5 BOARDS

A. Exposed Boards: Where boards will be exposed in the finished work, provide the following:

1. Moisture Content: 19 percent maximum.
2. Species and Grade: Spruce-pine-fir, C & Btr per WCLIB rules or C Select per NLGA or WWPA rules.
3. As noted on plans by Architect.

B. Concealed Boards: Where boards will be concealed by other work, provide lumber with 19 percent maximum moisture content and of following species and grade:

1. Species and Grade: Eastern softwoods, No. 3 Common per NELMA rules.
2. Species and Grade: Mixed southern pine, No. 2 per SPIB rules.
3. Species and Grade: Spruce-pine-fir, Standard per WCLIB rules or No. 3 Common per WWPA rules.
4. Species and Grade: Western woods, Standard per WCLIB rules or No. 3 Common per WWPA rules.
5. Species and Grade: Any species above.

2.6 MISCELLANEOUS LUMBER

A. General: Provide lumber for support or attachment of other construction, including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, grounds, stripping, and similar members.

B. Fabricate miscellaneous lumber from dimension lumber of sizes indicated and into shapes shown.

C. Moisture Content: 19 percent maximum for lumber items not specified to receive wood preservative treatment.

D. Grade: For dimension lumber sizes, provide No. 3 or Standard grade lumber per ALSC's NGRs of any species. For board-size lumber, provide No. 3 Common grade per NELMA, NLGA, or WWPA; No. 2 grade per SPIB; or Standard grade per NLGA, WCLIB or WWPA of any species.

2.7 ENGINEERED WOOD PRODUCTS

A. General: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that evidence compliance with building code in effect for Project.

1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis, and demonstrated by comprehensive testing performed by a qualified independent testing agency.

B. Laminated-Veneer Lumber: Lumber manufactured by laminating wood veneers in a continuous press using an exterior-type adhesive complying with ASTM D 2559 to produce members with grain of veneers parallel to their lengths and complying with the following requirements:

1. Extreme Fiber Stress in Bending: 2500 psi (17 MPa) for 12-inch nominal- (286-mm actual-) depth members.
2. Modulus of Elasticity: 2,000,000 psi (13 800 MPa).
3. Tension Parallel to Grain: 1850 psi (13 MPa).
4. Compression Parallel to Grain: 2800 psi (19 MPa).
5. Compression Perpendicular to Grain: 400 psi (3 MPa) perpendicular to and 500 psi (3.5 MPa) and parallel to glue line.
6. Horizontal Shear: 285 psi (2 MPa) perpendicular to and 190 psi (1.3 MPa) parallel to glue line.

C. Prefabricated Wood I-Joists: Units manufactured by bonding stress-graded lumber flanges to wood-based structural-use panel webs with exterior-type adhesives complying with ASTM D 2559, to produce I-shaped joists complying with the following requirements:

1. Flange Material: Laminated-veneer lumber.

2. Web Material: Oriented-strand board (OSB) complying with DOC PS 2.
3. Web Material: Plywood complying with DOC PS 2.
4. Web Material: Either material indicated above, as standard with joist manufacturer.
5. Structural Capacities: Establish and monitor structural capacities according to ASTM D 5055.
6. Sizes: Depths and widths as indicated, with flanges not less than 1-1/2 inches (38 mm) in actual width.
7. I-Joists shall be installed with all required anchors, stiffeners and bracing in accordance with manufacturer requirements.

2.8 CONCEALED, PERFORMANCE-RATED STRUCTURAL-USE PANELS

A. General: Where structural-use panels are indicated for the following concealed types of applications, provide APA-performance-rated panels complying with requirements designated under each application for grade, span rating, exposure durability classification, and edge detail (where applicable).

1. Thickness: Provide panels meeting requirements specified but not less than thickness indicated.
2. Span Ratings: Provide panels with span ratings required to meet "Code Plus" provisions of APA Form No. E30V, "APA Design/Construction Guide: Residential & Commercial."

B. Subflooring: APA-rated sheathing.

1. Exposure Durability Classification: Exposure 1.
2. Span Rating: 48/24.
3. Minimum thickness: 5/8 inch.
4. Floor sheathing shall be tongue and groove and installed with both construction adhesive and required nailing.

C. Wall Sheathing: APA-rated sheathing.

1. Exposure Durability Classification: Exposure 1.
2. Span Rating: As required to suit stud spacing indicated.
3. Minimum thickness indicated on plan.

D. Roof Sheathing: APA-rated sheathing.

1. Exposure Durability Classification: Exterior, Structural I, Exposure 1.
2. Minimum Span Rating: 32/16.
3. Minimum thickness: 3/4 inch.
4. Roof sheathing shall be installed with panel clips.

2.9 STRUCTURAL-USE PANELS FOR BACKING

A. Plywood Backing Panels: For mounting electrical or telephone equipment, provide fire-retardant-treated plywood panels with grade, C-D Plugged Exposure 1, in thickness indicated or, if not otherwise indicated, not less than 15/32 inch (11.9 mm) thick.

2.10 AIR-INFILTRATION BARRIER

A. Air retarder complying with ASTM E 1677; made from polyolefins; either cross-laminated films, woven strands, or spunbonded fibers; coated or uncoated; with or without perforations to transmit water vapor but not liquid water; and as follows:

1. Minimum Thickness: 3 mils (0.08 mm).
2. Minimum Water-Vapor Transmission: 10 perms (575 ng/Pa x s x sq. m) when tested according to ASTM E 96, Procedure A.
3. Maximum Flame Spread: 25 per ASTM E 84.
4. Minimum Allowable Exposure Time: 3 months.

2.11 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with a hot-dip zinc coating per ASTM A 153 or of Type 304 stainless steel.

B. Nails, Wire, Brads, and Staples: FS FF-N-105.

C. Power-Driven Fasteners: CABO NER-272.

D. Wood Screws: ASME B18.6.1.

E. Lag Bolts: ASME B18.2.1. (ASME B18.2.3.8M)

F. Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

G. All fasteners to secure pressure treated lumber/plywood shall be Type 304 Stainless Steel.

2.12 METAL FRAMING ANCHORS

A. General: Provide galvanized steel framing anchors of structural capacity, type, and size indicated and as follows:

1. Research or Evaluation Reports: Provide products for which model code research or evaluation reports exist that are acceptable to authorities having jurisdiction and that evidence compliance of metal framing anchors for application indicated with building code in effect for Project.
2. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis, and demonstrated by comprehensive testing performed by a qualified independent testing agency.

B. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653, G60 (ASTM A 653M, Z180) coating designation; structural, commercial, or lock-forming quality, as standard with manufacturer for type of anchor indicated.

C. Joist Hangers: U-shaped joist hangers with 2-inch- (50-mm-) long seat and 1-1/4-inch- (32-mm-) wide nailing flanges at least 85 percent of joist depth.

1. Thickness: 0.064 inch (1.6 mm).

D. Top Flange Hangers: U-shaped joist hangers, full depth of joist, formed from metal strap with tabs bent to extend over and be fastened to supporting member.

1. Strap Width: 2 inches (50 mm).
2. Thickness: 0.064 inch (1.6 mm).

E. Bridging: Rigid, V-section, nailless type, 0.064 inch (1.6 mm) thick, length to suit joist size and spacing.

F. Rafter Tie-Downs (Hurricane Ties): Bent strap tie for fastening rafters or roof trusses to wall studs below, 1-5/8 inches (41 mm) wide by 0.052 inch (1.3 mm) thick minimum. Tie-Downs must be selected to meet uplift forces as calculated in the wood truss design.

2.13 THERMO-PLY SHEATHING

A. Standard Grade – Green, 0.78" for use in attic to secure under truss rafter for supporting glass fiber insulation board.

B. Pre-cut to 24" wide strip for easy field installation.

C. Perm Rating: Minimum 0.63.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Discard units of material with defects that impair quality of rough carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.

B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted.

C. Fit rough carpentry to other construction; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other construction.

D. Apply field treatment complying with AWPA M4 to cut surfaces of preservative-treated lumber and plywood.

E. Comply with applicable recommendations contained in APA Form No. E30V, "APA Design/Construction Guide: Residential & Commercial," for types of structural-use panels and applications indicated.

1. Comply with "Code Plus" provisions in above-referenced guide.
2. Roof sheathing shall be installed with 1/8" spacing at all edge and end joints for expansion per APA recommendations in above-referenced guide.

F. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. CABO NER-272 for power-driven staples, P-nails, and allied fasteners.
2. Published requirements of metal framing anchor manufacturer.
3. "Recommended Nailing Schedule" of referenced framing standard and with AFPA's "National Design Specifications for Wood Construction."
4. "Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

G. Use common wire nails, unless otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; predrill as required.

H. Use double hot-dip galvanized or stainless-steel nails where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity.

I. Countersink nail heads on exposed carpentry work and fill holes with wood filler.

3.2 WOOD FRAMING, GENERAL

A. Framing Standard: Comply with AFPA's "Manual for Wood Frame Construction," unless otherwise indicated.

B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

C. Install framing members of size and at spacing indicated.

D. Do not splice structural members between supports.

E. Firestop concealed spaces of wood-framed walls and partitions at each floor level and at ceiling line of top story. Where firestopping is not inherent in framing system used,

provide closely fitted wood blocks of 2-inch nominal- (38-mm actual-) thickness lumber of same width as framing members.

3.3 THERMO-PLY SHEATHING:

A. Provide conceal envelope in attic to support board insulation and to act as a vapor barrier.

B. Pre-cut 24" wide strip to secure under wood truss rafter. Cut edge to clear truss web member.

C. Tape joint between rafter without wood backing.

3.4 AIR-INFILTRATION BARRIER

A. Cover sheathing with air-infiltration barrier as follows:
   1. Apply air retarder to comply with manufacturer's written instructions.
   2. Apply air-infiltration barrier to cover upstanding flashing with 4-inch (100-mm) overlap.

END OF SECTION 06100

SECTION 06160 - CEMENT BOARD SHEATHING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Weather-Resistant Sheathing Barriers.

1.02 REFERENCES

A. American National Standards Institute:

1. ANSI A118.9: Specification for Cementitious Backer Units.

B. American Society for Testing and Materials:

1. ASTM C 954: Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 inch to 0.110 inch in Thickness.
2. ASTM C 1002: Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
3. ASTM C 1280: Standard Specification for Application of Gypsum Sheathing.
4. ASTM C 1325: Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cement Interior Substrate Sheets.
5. ASTM D 226: Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
6. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials.
7. ASTM E119: Test Method for Fire Tests of Building Construction and Materials.
8. ASTM E 1677: Standard Specification for an Air Retarder (AR) Material or System for Low-Rise Framed Building Walls.

C. Gypsum Association:

1. GA 253: Recommended Specification for the Application of Gypsum Sheathing.

1.03 SUBMITTALS

A. General: Submit in accordance with Section 01300

B. Product Data: Submit manufacturer's current technical literature for product specified.

1.04 QUALITY ASSURANCE

A. Fire Resistance Rated Assembly Characteristics: Provide materials and construction identical to those tested in accordance to ASTM E 119 by an independent testing and inspection agency acceptable to authorities having jurisdiction.

1. Fire Resistance Ratings: Indicated by design designations from UL Fire Resistance Directory.

1.05 DELIVERY, STORAGE, AND HANDLING

A. All materials shall be delivered in their original unopened packages and stored in an enclosed shelter providing protection from damage and exposure to the elements. WARNING: Store all DUROCK Brand Cement Board flat. Panels are heavy and can fall over, causing serious injury or death. Do not move unless authorized.

PART 2 - PRODUCTS

2.01 WALL SHEATHING

A. Cementitious Fiber-Mat Reinforced Sheathing: ASTM C 1325, ANSI A118.9, cementitious backer.

1. Product: Subject to compliance with requirements, provide DUROCK Brand Cement Board by United States Gypsum Company or approved equal
2. Type and Thickness: 5/8 inch thick.
3. Size: 48 by 96 inches.

2.02 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and application.

B. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: DUROCK Brand Steel or USG Sheathing SF steel drill screws 1-5/8 inch with corrosion-resistant coating.

1. For steel framing less than 0.0329 inch thick, attach sheathing to comply with ASTM C 1002.
2. For steel framing from 0.033 to 0.112 inch thick, attach sheathing to comply with ASTM C 954.

2.03 WEATHER-RESISTANT SHEATHING BARRIERS

A. Building Paper: ASTM D 226, Type 1 (No. 15 asphalt-saturated organic felt), unperforated.

B. Building Wrap: ASTM E 1677, Type I air retarder, with flame-spread and smoke-developed indexes of less that 25 and 450, respectively, when tested according to ASTM E 84, UV stabilized and acceptable to authorities having jurisdiction.

1. Products: Subject to compliance with requirements, provide Tyvek StuccoWrap by DuPont (E. I. du Pont de Nemours and Company) or approved equal.

C. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

2.04 MISCELLANEOUS MATERIALS

A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film.

B. Primer for Flexible Flashing: Product recommended by manufacturer of flexible flashing for substrate.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.

C. Coordinate wall sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

D. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

3.03 GYPSUM SHEATHING INSTALLATION

A. Comply with ASTM C 1280, GA-253 and manufacturer's written instructions.

1. Fasten sheathing to cold-formed metal framing with screws.
2. Install boards with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing boards but do not cut into facing.

C. Horizontal Installation: Abut ends of boards over centers of studs, and stagger end joints of adjacent boards not less than one stud spacing. Attach boards at perimeter and within field of board to each stud.

1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.
2. For sheathing under stucco cladding, boards may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

D. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.

1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.
2. For sheathing under stucco cladding, boards may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

3.04 WEATHER-RESISTANT SHEATHING BARRIER INSTALLATION

A. General: Cover framing with weather-resistant sheathing paper as follows:

1. Cut back barrier 1/2 inch on each side of the break in supporting members at expansion- or control-joint locations.
2. Apply barrier to cover vertical flashing with a minimum 4-inch overlap, unless otherwise indicated.

B. Building Paper: Apply horizontally with a 2-inch overlap and a 6-inch end lap; fasten to framing with galvanized staples or roofing nails.

C. Building Wrap: Comply with manufacturer's written instructions.

1. Seal seams, edges, fasteners, and penetrations with tape.
2. Extend into jambs of openings and seal corners with tape.

3.05 FLEXIBLE FLASHING INSTALLATION

A. Apply flexible flashing where indicated to comply with manufacturers written instructions.

1. Prime substrates as recommended by flashing manufacturer.
2. Lap seams and junctures with other materials at least 4 inches, except that at flashing flanges of other construction, laps need not exceed flange width.
3. Lap flashing over weather-resistant building paper at bottom and sides of openings.
4. Lap weather-resistant building paper over flashing at heads of openings.
5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

3.06 PROTECTION

A. Cementitious Fiber-Mat Reinforced Sheathing: A continuous water barrier must be installed over the studs and lap over the flashing. Weeps must be provided to allow water drainage out of the system at all horizontal terminations

END OF SECTION 06160

SECTION 07190 - VAPOR BARRIER

PART 1 – GENERAL

1.1 SUMMARY

A. Products supplied under this section:
   1. Vapor barrier, seam tape, mastic, pipe boots, detail strip for insulation under concrete slabs.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM E 1745 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
   2. ASTM E 164-99 (2005) Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
   3. ASTM E 96-05 Standard Test Methods for Water Vapor Transmission of Materials.
   4. ASTM F 1249-06 Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.
   5. ASTM E 1643 Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.

B. American Concrete Institute (ACI):
   1. ACI 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.

1.3 SUBMITTALS

A. Quality control/assurance:
   1. Full set of test results as per paragraph 8.3 of ASTM E 1745.
   2. Manufacturer's samples, literature.
   3. Manufacturer's installation instructions for placement, seaming and penetration repair instructions.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Vapor barrier must have all of the following qualities:
   1. Permeance as tested after conditioning of less than 0.03 Perms [grains/(ft^2 · hr · inHg)] as tested in accordance with ASTM E 1745 Paragraphs 7.1.2-5.
   2. Other performance criteria:
      a. Strength: ASTM E 1745 Class A.
      b. Minimum thickness of the plastic retarder material: 10 mils.

B. Vapor barrier products:
   1. Basis of Design: Stego Wrap Vapor Barrier (10-mil) by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com. Approved equal substitutions will be considered in accordance with Specification Section 01300-Submittals.

2.2 ACCESSORIES

A. Seam tape:
1. Stego Tape by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
2. Or approved equal.

B. Vapor-proofing mastic:
1. Stego Mastic by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
2. Or approved equal.

PART 3 – EXECUTION

3.1 PREPARATION

A. Ensure that base material is approved by Architect or Geotechnical Engineer.
1. Level and compact base material.

3.2 INSTALLATION

A. Install vapor barrier retarder in accordance with manufacturer's instructions and ASTM E 1643.
1. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement.
2. Lap vapor barrier over footings and/or in recessed haunches for a continuous installation. Seal the vapor barrier to the foundation walls.
3. Overlap joints 6 inches and seal with manufacturer's tape.
4. Seal all penetrations (including pipes) per manufacturer's instructions.
5. No penetration of the vapor barrier is allowed except for reinforcing steel and permanent utilities.
6. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6 inches and taping all sides with tape.

END OF SECTION

SECTION 07200 - WATER REPELLENTS

1.1 GENERAL

A. Submit Product Data for each product specified.

B. Warranty: 5-Year Manufacturer's Authorized Warranty. The water repellent test should be done before the application to determine the material needed to coat the surface.

1.2 PRODUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

1. BASF – Master Builders Solutions – MasterProtect H 177 for Brick
2. MAB - Modac Products Company - Siloxane 40
3. STO Concrete Restoration Division - STO Penetration Sealer CR650
4. Chemprobe Technologies, Inc. - Chemprobe Prime-A-Pell H20 for Brick

B. Siloxanes: Penetrating water repellent. Alkylalkoxysiloxanes that are oligomerous with alcohol, ethanol, mineral spirits, water, or other solvent carrier.

1. With more than 8.3-lb/gal. (400-g/L) VOCs.

C. Silane/Siloxane Blends: Consisting of silanes and siloxanes blended to achieve a particular penetration and protection on a specific substrate.

1. With more than 8.3-lb/gal. (400-g/L) VOCs.

2.1 EXECUTION

A. **A preconstruction on site meeting is required** with the manufacturer's representative to verify the existing conditions, moisture test and sample area completed prior to the preconstruction meeting conform to the manufacturer's installation requirements and warranty.

B. Preparation: Clean substrate and test for moisture content according to repellent manufacturer's written instructions.

1. Clay Brick Masonry: Clean clay brick masonry per ASTM D 5703.

C. Test for pH level, according to water repellent manufacturer's written instructions, to ensure chemical bond to silicate minerals.

D. Protect Adjoining Work: Cover nearby surfaces of aluminum and glass. Cover live plants and grass.

E. Coordination with Sealants: Do not apply water repellent until sealants have been installed and cured.

F. Application: Apply at the end of the project after the masonry has been completed for a minimum of six (6) months. If the Substantial Completion date is prior to this, the Contractor shall re-mobilize and complete this scope following the Substantial Completion date. Comply with manufacturer's written instructions. Apply a mist coat and a heavy-saturation coat using low-pressure spray equipment. Apply a second coat per manufacturer's written instructions.

G. Remove protective coverings from adjacent surfaces and other protected areas.

H. Clean adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses per manufacturer's written cleaning instructions. Repair damage caused by water-repellent application.

2.2 LOCATION

A. The following areas are to be coated by this product.

1. All new brick veneer work.

END OF SECTION 07200

SECTION 07210-BUILDING INSULATION

1.1 GENERAL

A. Submittals: Product Data for each type of insulation product specified.

B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated as determined by testing identical products per NFPA 285, ASTM E 84, ASTM E 119, or ASTM E 136 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1.2 PRODUCTS

A. General: Provide insulating materials that comply with requirements and with referenced standards.

1. Preformed Units: Sizes to fit applications indicated; selected from manufacturer's standard thickness, widths and lengths.

B. For below slab insulation: Extruded-Polystyrene Board Insulation: ASTM C 578 for type indicated below:

1. Under Slab Type IV, 1.60-lb/cu. ft. (26-kg/cu. m) minimum density.

C. For masonry cavity insulation: Board Insulation: Polyisocyanurate Foam – Board Insulation: ASTM C 1289, foil faced, Type I, Class 1 or 2. Do not tape the Board joints. Leave joints open for vapor permeability.

1. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

D. For all interior walls: Unfaced Mineral-Fiber Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing) of type described below:

1. Mineral-Fiber Type: Fibers manufactured from glass. (3 5/8" R=13, 6" R=19).
2. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indices of 25 and 50, respectively.

E. For all Exterior Stud Walls or Attic Spaces: Unfaced Mineral-Fiber Blanket Insulation: ASTM C 665, Type III, Class A.

1. Mineral-Fiber Type: Fibers manufactured from glass. (6" R=19)

F. For use as fire stop at openings between edge of slab and exterior wall panels: Provide a fire tested assembly where required. Slag-Wool-Fiber Board Safing Insulation: Semirigid boards designed and produced by combining slag-wool fibers with thermosetting resin binders to comply with ASTM C 612, Type IA and IB; nominal density of 4 lb/cu. ft. (64kg/cu. m); passing ASTM E 136 for combustion characteristics; thermal resistivity of 4 deg. F x h x sq. ft./Btu x in. at 75 deg F (27.7 K x m/W at 24 deg C).

1. Calking Compound: Material approved by manufacturer of safing insulation for sealing joint between foil backing of safing insulation and edge of concrete floor slab against penetration of smoke.
2. Safing Clips: Galvanized steel safing clips approved by manufacturer of safing insulation for holding safing insulation in place.

G. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of hooding insulation, of thickness indicated, securely in position indicated with self-locking washer in place; and complying with the following requirements:

1. Plate: Perforated galvanized carbon-steel sheet, 0.030 inch (0.762 mm) thick by 2 inches (50 mm) square.
2. Spindle: Copper-coated low carbon steel, fully annealed, 0.105 inches (2.67 mm) in diameter, length to suit depth of insulation indicated.

1.3 EXECUTION

A. Installation, General: Comply with insulation manufacturer's written instructions applicable to products and application indicated.

1. Install insulation that is undamaged, dry, unsoiled, and has not been exposed at any time to ice and snow.
2. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
3. Apply single layer of insulation to produce thickness indicated.
4. Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.
5. Seal joints between closed-cell (nonbreathing) insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant.
6. Install mineral-fiber blankets in cavities formed by framing members according to the following requirements:

    a. Use blanket widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
    b. Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.

7. Install insulation in curtain-wall construction where indicated on Drawings according to curtain-wall manufacturer's written instructions.
8. Retain insulation in place by metal clips and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place without touching spandrel glass. Maintain cavity width of dimension indicated between insulation and glass.
9. Install insulation where it contacts perimeter fire-containment system to prevent insulation from bowing under pressure from perimeter fire-containment system.

10. Stuff glass-fiber, loose-fill insulation into miscellaneous voids and cavity spaces where shown. Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).
11. Attic insulation board should be a tight fit at the bottom of the rafters. Apply thermo-ply sheathing under insulation board to act as vapor barrier and insulation board support.
12. In between bathroom walls and cavity walls where there is no gypsum wall board sheathing on the inside face, provide horizontal metal straps between studs at 48" on center to hold insulation in place.

B. Protect below-grade insulation on vertical surfaces from damage during backfilling by applying protection board. Set in adhesive according to written instructions of insulation manufacturer.

C. Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors.

D. Place loose-fill insulation into spaces and onto surfaces as shown, either by pouring or by machine blowing to comply with ASTM C 1015.

E. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84 for surface-burning characteristics, by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

END OF SECTION

SECTION 07272 – FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The General Conditions, Supplementary Conditions, Instructions to Bidders, and Division 01- General Requirements shall be read in conjunction with and govern this section.

B. The Specification shall be read in its entirety by all parties concerned. Each Section may contain more or less than the complete Work of any trade. The Contractor is solely responsible to make clear to the Subcontractor the extent of their Work.

C. Throughout this Section there is basis of design products listed. Approved equal substitutions will be considered in accordance with Specification Section 01300-Submittals.

1.2 SUMMARY

A. This Section includes requirements for supplying labor, materials, tools, and equipment to complete the Work as shown on the Drawings as specified herein including, but not limited to, the following:

1. Adhesives/Primers
2. Fluid Applied, Vapor Permeable Air & Water Barrier Membrane
3. Transition Membranes
4. Sealant
5. Thru-wall flashing

1.3 DEFINITIONS

A. Air barrier Material: A primary element that provides a continuous barrier to the movement of air.

B. Airbarrier Accessory: A transitional component of the air barrier that provides continuity.

C. Airbarrier Assembly: The collection of air-barrier materials and accessory materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

D. Transition Membranes has the same meaning as Transition Strips.

1.4 REFERENCES

A. American Architectural Manufacturers Association (AAMA):

1. AMMA 2400-02, Standard Practice for Installation of Windows with a Mounting Flange in Stud Frame Construction

B. American Society for Testing and Materials (ASTM):

1. ASTM D412, Standard Test Method for Vulcanized Rubber and Thermoplastic Elastomers - Tension
2. ASTM D471, Standard Test Method for Rubber Property - Effect of Liquids
3. ASTM D1970, Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
4. ASTM D2243, Standard Test Method for Freeze-Thaw Resistance of Water-Borne Coatings
5. ASTM D5590, Standard Test Method for Determining the Resistance of Paint Films and Related Coatings to Fungal Defacement by Accelerated Four-Week Agar Plate Assay
6. ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials
7. ASTM E96, Standard Test Methods for Water Vapor Transmission of Materials
8. ASTM E283, Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
9. ASTM E330, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
10. ASTM E331, Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
11. ASTM E1354, Standard Test Method for Heat and Visible Smoke Release Rates for Materials and Products Using an Oxygen Consumption Calorimeter
12. ASTM E1677, Standard Specification for Air Barrier (AB) Material or System for Low- Rise Framed Building Walls
13. ASTM E2112, Standard Practice for Installation of Exterior Windows, Doors and Skylights
14. ASTM E2178, Standard Test Method for Air Permeance of Building Materials
15. ASTM E2357, Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

C. National Fire and Protection Agency (NFPA):

1. NFPA 285, Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the Work of this Section with the installation of exterior substrate. Sequence Work so that installation of fluid-applied air barrier coincides with installation of substrate preparation without causing delay to the Work.

B. Pre-installation meetings:

1. Pre-installation Conference: Conduct conference at Project site.
2. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.
3. Air marrier manufacturer representative will meet with the necessary parties at the jobsite to review and discuss project conditions as it relates to the integrity of the assembly.

1.5 SUBMITTALS

A. ACTION SUBMITTALS:

1. Product Data: For each type of product.

   a. Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of products.
   b. Air barrier manufacturer's guide specification.
   c. Air marrier manufacturer's complete set of technical data sheets for assembly.
   d. Air marrier manufacturer's complete set of standard detail drawings.

2. Shop Drawings: For air-barrier assemblies.

   a. Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
   b. Include details of interfaces with other materials that form part of air barrier.

B. INFORMATIONAL SUBMITTALS

1. Qualification Data: For Installer. Include list of ABAA-certified installers and supervisors employed by the Installer, who work on Project.
2. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.
3. Product Test Reports: For each product, for tests performed by a qualified testing agency.

   a. NFPA 285 wall assembly compliance: Air barrier manufacturer statement that anticipated wall assembly passes NFPA 285.

4. Evaluation Reports: from ICC-ES
5. Product certification that the assembly components are supplied and warranted by single source air barrier manufacturer.

6. Statement that installing contractor is authorized by air barrier manufacturer to complete Work as specified.
7. Statement that materials are adhesively and chemical compatible with adjacent materials proposed for use.
8. Reports indicating that field peel-adhesion test on all materials to which sealants are adhered have been performed and the changes made, if required, to other approved materials, in order to achieve successful adhesion.
9. Letter from primary materials manufacturer indicating compatibility of products not manufactured by primary manufacturer.
10. Submit Eco-Efficiency Analysis of each material.
11. Submit recommended values for field adhesion test on each substrate.
12. Submit accreditation number of manufacturer and certification number of installers.
13. Warranty: Sample warranty as specified.

1.6 QUALITY ASSURANCE

A. Single Source Responsibility:

1. Obtain fluid-applied membrane air barrier, transition membranes, air barrier sealants, primers, mastics, and adhesives from a single air barrier manufacturer regularly engaged in the manufacturing and supply of the specified products.
2. Contactor to verify product compliance with federal, state, and local regulations controlling use of Volatile Organic Compounds (VOC).

B. Manufacturer Qualifications:

1. The Contractor shall demonstrate qualifications to supply materials of this section by certifying the following:

a. Air marrier manufacturer must not issue warranties for terms longer than they have been manufacturing and supplying specified products for similar scope of Work.

C. Installer Qualifications:

1. Perform Work in accordance with air marrier manufacturer published literature and as specified in this section.

a. Installer shall be licensed by ABAA according to ABAA's Quality Assurance Program and shall employ ABAA-certified installers and supervisors on Project.

2. Maintain one (1) copy of air barrier manufacturer's instructions on site.
3. At all times during the execution of the Work allow access to site by the air barrier manufacturer representative.

D. VOC Regulations: Provide products which comply with applicable regulations controlling the use of volatile organic compounds.

E. Preconstruction Meeting: Organize and convene a minimum of two weeks prior to commencing Work of this Section. Agenda shall include, at a minimum, construction and testing of mock- up, sequence of construction, coordination with substrate preparation, materials approved for use, compatibility of materials, coordination with installation of adjacent and covering materials, and details of construction. Contractor is responsible for all site safety requirements. Attendance is required by representatives of related trades including covering materials, substrate materials and adjacent materials.

1.7 MOCK-UPS

A. Construct mock-ups to verify selections made under submittals and to set quality standards for materials and execution in accordance with requirements.

B. Mock-Ups: The Contractor is responsible for coordinating the construction of the mock-up. Mock-up shall be representative of primary exterior wall assemblies and glazing assemblies including backup wall, air-barrier assemblies and typical penetrations. Mock-up shall be approximately 8 feet long by 8 feet high and include all components in the exterior wall assembly and as indicated.

C. Mock-Up Tests for Adhesion: Test mock-up of materials for adhesion in accordance with manufacturer's recommendations. Perform test after curing period recommended by the manufacturer. Record mode of failure and the area(s) which failed the project requirements. When the air barrier material manufacturer has established a minimum adhesion level for the product on the particular substrate, the inspection report shall indicate whether this requirement has been met.

1.8 MANUFACTURERS QUALIFICATIONS / ALTERNATE MANUFACTURERS:

A. The materials outlined are the type of materials to be used on this project. Please refer to Specification Section 01300, "Submittals." "Or Equal" substitutions are permitted so long as they are equal to or superior to the basis of design and the Contractor takes full responsibility for all coordination and costs associated with collateral issues related to the substitution.

1.9 PERIODIC INSPECTION BY MANUFACTURER'S REPRESENTATIVE

A. When the project is in progress, the air barrier manufacturer shall inspect the work not less than 2 days per week. In addition, the manufacturer shall:

1. Keep the architect and Owner's on-site representative informed as to the progress and quality of the work as observed.
2. Report to architect and Owner's on-site representative in writing any failure or refusal of the Contractor to correct unacceptable practices called to the Contractor's attention.
3. Confirm after completion that manufacturer has observed no applications procedures in conflict with the specifications other than those that may have been previously reported and corrected.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Delivery of Materials:

1. Materials shall be delivered to the jobsite in undamaged and clearly marked containers indicating the name of the air barrier manufacturer and product.

B. Storage of Materials:

1. Store materials as recommended by the air barrier manufacturer and conforming to applicable safety regulatory agencies. Refer to all applicable data including but not limited to MSDS sheets, Product Data sheets, product labels, and specific instructions for personal protection.
2. Keep solvents away from open flame or excessive heat.
3. Products should be stored in closed containers.
4. Store rolled materials on end in original packaging.
5. Protect rolls from direct sunlight until ready for use.
6. Refer to air barrier manufacturer published literature.

C. Handling:

1. Refer to air barrier manufacturer's published literature.

1.11 SITE CONDITIONS

A. Environmental Requirements:

1. No work shall be performed during rain or inclement weather.
2. No work shall be performed on frost or wet covered surfaces.

B. Protection:

1. Cap and protect exposed back-up walls against wet weather conditions during and after application of membrane.

C. Ensure all preparation Work is completed prior to installing fluid-applied membrane air barrier.

1.12 WARRANTY

A. Provide manufacturer's exposure warranty that offers twelve (12) months of coverage against in-place exposure damage (delamination, deterioration) beginning with the date of installation of the product.

B. Provide manufacturer's standard warranty for sheathing to be free of manufacturing defects that make it unsuitable for its intended use. Warranty period shall be Ten (10) years from the date of Purchase.

C. Installer's Warranty: Provide an Installer's Warranty for two (2) years from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS MANUFACTURER

D. Components and auxiliary materials must be obtained as a single source from the assembly the Contractor to ensure total system compatibility and integrity.

E. Basis of Design (Approved equal substitutions will be considered in accordance with Specification Section 01300-Submittals.)
1. Henry Company
2. Or Approved Equal

2.2 MATERIALS

A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

B. Primary Fluid-Applied Membrane Air Barrier (Basis of Design):

1. One-component, water-based, elastomeric emulsion membrane, designed to provide a vapor permeable air and water barrier when applied above-grade wall assemblies, having the following properties:

a. Basis of Design Product: Air-Bloc 17MR or approved equal
b. Color: Graphite
c. Solids Content:

1) By Weight: 63%
2) By Volume: 53%

d. Service Temperature:

1) Low Temperature: -40 degrees F (-40 degrees C)
2) High Temperature: +180 degrees F (+80 degrees C)

e. Application Temperature:

1) Low Temperature: +20 degrees F (-6 degrees C)
2) High Temperature: +122 degrees F (+50 degrees C)

f. Tensile Strength (ASTM D412): 104 psi (717 kPa)
g. Elongation (ASTM D412): 420%
h. Low Temperature Flexibility @ -22 degrees F (-30 degrees C) (ASTM D1970): Pass
i. Freeze-Thaw Resistance (ASTM D2243): Pass; 10 cycles
j. Nail Sealability (ASTM D1970): Pass

k. VOC Content: 100 grams/liter max.
l. Water Absorption (ASTM D471, modified): 5.6%
m. Water Vapor Permeance (ASTM E96 B) @ 40 mils nominal dry film: 14 perms
n. Air Permeability:

1) Assembly Air Leakage (ASTM E2357): Pass
2) Building Material (ASTM E2178): 0.0001 cfm/ft2 (0.0005 L/s.m2)

o. Chemical Resistance: Resists salt solutions, mild acids and alkalis. Non-resistant to oils, grease or solvents
p. Fire Testing (NFPA 285): Complies in various assemblies
q. Flame Spread/Smoke Development (ASTM E84): 10/15
r. Resistance to Mold, Mildew, and Fungal Growth (ASTM D5590): No growth

C. Auxiliary Materials

1. Transition Membranes:

a. Liquid applied flashings:

1) Moisture-curing one component elastomeric liquid applied flashing membrane using a highly advanced STPe (Silyl-Terminated Polyether) polymer, having the following properties:

a) Basis of Design Product: Air-Bloc LF or approved equal
b) Color: Blue
c) Air Leakage (ASTM E2178): <0.004 L/s/m^2 @ 75Pa
d) Water Vapor Permeance (ASTM E96, Method B): 21.8 perms @25 mils
e) Air Leakage of air barrier assemblies (ASTM E2357): Pass
f) Water Resistance (AC212/ASTM D2247): Pass
g) Nail Sealability (AMMA 711): Pass
h) Surface Burning Characteristics (ASTM E84):

2) Class A
3) Flame Spread/Smoke Development (ASTM E84): 20/5

a) Tensile Strength (ASTM D412): 132 psi
b) Elongation (ASTM D412): 264%

b. Self-Adhering flashings:

1) Non-vapor permeable, self-adhered water resistive air and vapor barrier membrane consisting of an SBS rubberized asphalt

compound, which is integrally laminated to a blue engineered thermoplastic film, having the following properties:

a) Basis of Design Product: Blueskin SA or approved equal
b) Color: Blue
c) Water Vapor Permeance (ASTM E96, Method A): .86 perms
d) Air Leakage of Air Barrier Assemblies (ASTM E2357): Pass
e) Air Leakage (ASTM E2178): <0.0005 L/s/m^2 @ 75Pa
f) Water Tightness (CAN/CGSB-37.58-M86): Pass.
g) Nail Sealability (ASTM D1970): Pass.
h) Tensile Strength:

2) Membrane (ASTM D412-modified): 500 psi minimum
3) Film (ASTM D828): 5000 psi minimum

a) Elongation (ASTM D412-modified): 200% minimum

2. Sheathing Joint Membranes:

a. Vapor permeable, self-adhered water resistive air barrier membrane consisting of an engineered film and patented, permeable adhesive technology with split-back poly-release film, having the following properties:

1) Basis of Design Product: Blueskin VP160 or approved equal
2) Color: Blue
3) Air Leakage (ASTM E2178): <0.02 L/s/m^2 @ 75Pa
4) Water Vapor Permeance (ASTM E96, Method A): 29 perms
5) Air Leakage of Air Barrier Assemblies (ASTM E2357): Pass
6) Resistance to Water Penetration (ICC-ES AC 38): Pass.
7) Nail Sealability (ASTM D1970): Pass
8) Surface Burning Characteristics (ASTM E84):

a) Class A
b) Flame Spread/Smoke Development (ASTM E84): 0/105

9) Tensile Strength (ASTM D828): 182N MD/129N CD
10) Cycling and Elongation (ICC-ES AC48): Pass

3. Adhesives and Primers:

a. Spray adhesive, and having the following properties:

1) Basis of Design Product: Blueskin Spray Prep or approved equal
2) Color: Clear amber
3) Solids Content (By Weight): 35%
4) Aerosol

b. Polymer emulsion based adhesive type, quick setting, low VOC content, having the following properties:

1) Basis of Design Product: Blueskin LVC Adhesive or approved equal.
2) Color: Blue.
3) Solids Content (By Weight): 40%.
4) Solvent based: 240 g/L.

c. Polymer emulsion-based primer for self-adhered membranes, and having the following properties:

1) Basis of Design Product: Aquatac Primer or approved equal
2) Color: Aqua.
3) Solids Content (By Weight): 58%.
4) Water based: Maximum VOC: 50 g/l

4. Sealants:

a. Building Envelope Sealant:

1) Moisture cure, medium modulus polymer modified sealing compound, having the following properties:

a) Basis of Design Product: HE925 BES Sealant or approved equal
b) Complies with Fed. Spec. TT-S-00230C, Type II, Class A.
c) Complies with ASTM C920, Type S, Grade NS, Class 35.
d) Elongation: 450 – 550%.
e) Remains flexible with aging.

b. Sheathing Joint Sealants:

1) As recommended by the air barrier manufacturer

c. Contact the air barrier manufacturer for a complete list of authorized sealants.

5. Self-Adhesive Thru-Wall Flashing Membrane:

a. Non-vapor permeable, self-adhered water resistive air and vapor barrier membrane consisting of an SBS rubberized asphalt compound, which is integrally laminated to a blue engineered thermoplastic film, having the following properties:

1) Basis of Design Product: Blueskin TWF or approved equal
2) Color: Yellow
3) High Temperature Stability - Flow Resistance (ASTM D5147): Pass
4) Air leakage (ASTM E283): 0.005 L/s.m^2 @ 75 Pa
5) Water vapor permeance (ASTM E96, Method B): 0.03 perms

6) Low temperature flexibility (CGSB 37-GP-56M): Pass

6. Termination bar: stainless steel with sealant receiver.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Substrate Conditions:

1. Verify substrates to receive work and surrounding adjacent surfaces are in accordance with Air Barrier Manufacturer published literature prior to installation of fluid applied membrane air barrier assembly.
2. Sheathing panels must be securely fastened and installed flush to ensure a continuous substrate in accordance with Air Barrier Manufacturer published literature.
3. Fastener penetrations must be set flush with sheathing and fastened into solid backing.
4. Mortar joints in concrete block and form tie holes/voids in poured concrete shall be filled, flush, smooth, and allowed to be cured for a minimum of twenty-four (24) hours.
5. New concrete should be cured for a minimum of sixteen (16) hours after forms are removed.
6. Cap and protect exposed back-up walls against wet weather conditions prior to application of fluid applied membrane air barrier assembly.
7. Exterior surfaces of existing CMU walls are parged with ± ½ inch of portland cement mortar with a high variability of surface irregularity.

a. CMU and Parging Repair is described in the Drawings

B. Notify the Owner in writing of any conditions that are not acceptable.

C. The installing contractor shall examine and determine that surfaces and conditions are ready to accept the Work of this section in accordance with published literature. Commencement of Work or any parts thereof shall mean installer acceptance of the substrate.

3.2 PREPARATION

A. All surfaces must be sound, dry to touch, clean, and free of oil, grease, dirt, excess mortar, frost, laitance, loose and flaking particles, or other contaminants.

B. Protect adjacent surfaces not included in scope of Work to prevent spillage and overspray.

C. Hot weather or direct-sun applications over porous substrates, such as concrete, promote rapid surface drying and can form blisters in the fluid applied membrane air barrier during curing. To aid in blister prevention prepare substrate in accordance with one of the following optional procedures:

1. Prime coat:

    a. Apply a thin prime coat of fluid applied membrane air barrier to substrate.
    b. Allow fluid applied membrane air barrier to fully cure prior to subsequent application.
    c. Install primary fluid applied membrane air barrier to Air Barrier Manufacturer minimum recommended mil thickness.

2. Two coat:

    a. Apply fluid applied membrane air barrier to achieve one-half (1/2) of Air Barrier Manufacturer minimum recommended mil thickness.
    b. Allow fluid applied membrane air barrier to fully cure prior to subsequent application.
    c. Apply fluid applied membrane air barrier to achieve one-half (1/2) of Air Barrier Manufacturer minimum recommended mil thickness.
    d. Overall dry mil thickness shall be in accordance with Air Barrier Air Barrier Manufacturer published literature.

3.3 INSTALLATION

A. Ensure substrate is ready to receive fluid applied membrane air barrier in accordance with published literature.

B. If fluid applied membrane air barrier should freeze while in storage, move containers to a controlled environment above 32 degrees F (0 degrees C) until thawed and re-mix using a hand operated power mixer prior to use.

C. Fluid applied membrane air barrier shall not be applied when ambient (air) and substrate temperatures are below 20 degrees F (-6 degrees C).

D. Do not proceed with application of air barrier membrane when rain is expected within 16 hours.

E. Apply sealant at sharp corners, changes in substrate plane, penetrations, and edges to form a smooth transition from one plane to another.

F. Non-Moving Substrate Joint and Crack Treatment:

1. Gaps equal to or less than 3/8 inch (10 mm) wide:

    a. Sheathing Joint Sealant:

        1) Apply sealant at rate recommended by the air barrier manufacturer.
        2) Spread sealant at joint extending a minimum one (1) inch beyond gap to ensure a continuous air and watertight assembly.

2. Gaps equal to or less than 1/2 inch (12 mm) wide:

   a. Building Envelope Sealant:

      1) Apply sealant at rate recommended by the air barrier manufacturer.
      2) Spread sealant at joint extending a minimum one (1) inch on each side of substrate gap.

   b. Liquid applied flashings:

      1) Apply liquid applied flashing at rate recommended by the air barrier manufacturer
      2) Apply liquid applied flashing in accordance with the air barrier manufacturer published literature extending a minimum of two (2) inches on each side of substrate gap.

   c. Self-adhering flashings:

      1) Apply primer to substrate and allow curing in accordance with published literature prior to installation of self-adhered flashing.
      2) Apply self-adhering flashing in accordance with Air Barrier Manufacturer published literature extending a minimum of three (3) inches on each side of substrate gap.
      3) Roll membrane with countertop roller to eliminate air pockets between self- adhered flashing and substrate ensuring full adhesion of membrane onto substrate.
      4) Seal exposed leading edges of self-adhered membrane with sealant.

3. Gaps greater than 1/2 inch wide:

   a. Contact the air barrier manufacturer.

G. Refer to Drawings and air barrier manufacturer requirements for installation procedures including, but not limited to, the following:

1. General:

   a. Coordinate all requirements and notify the architect and the Owner's on site representative of conflicting direction noted. Do not proceed with the work until the conflict is resolved and written notice is given on how to proceed.

2. Inside corners
3. Outside corners
4. Crack treatment
5. Penetrations
6. Rough openings

7. Control joints
8. Expansion joints
9. Changes in substrate

H. Contact the air barrier manufacturer to coordinate transition of fluid applied membrane air barrier to adjacent areas including, but not limited to, the following:

1. Roof to air barrier
2. Air barrier to waterproofing
3. Fastener penetrations
4. Foundation and walls, including penetrations, ties and anchors.
5. Walls, windows, curtain walls, storefronts, louvers or doors.
6. Dissimilar wall assemblies and fixed openings within those assemblies.
7. Wall and roof connections.
8. Floors over unconditioned space.
9. Walls, floor and roof across construction, control and expansion joints.
10. Utility, pipe and duct penetrations.
11. Seismic and expansion and control joints.
12. Leakage pathways in the building envelope.

I. Thru-Wall Flashing:

1. Coordinate with Section 04210 - Unit Masonry
2. Provide drip plate as indicated.

J. Primary Liquid Air Barrier Membrane

1. Install fluid applied membrane air barrier in accordance with the air barrier manufacturer published literature to ensure an air and watertight fluid applied membrane air barrier assembly.
2. Fluid applied membrane air barrier assembly must be installed in a monolithic application without sags, runs or voids, and transitioning with auxiliary components to create a uniform drainage plane and air barrier.
3. Install fluid applied membrane air barrier and transition membranes so that subsequent membrane installation laps one (1) inch (2.5 cm) onto existing membrane ensuring an air and watertight fluid applied membrane air barrier assembly.
4. Fluid applied membrane air barrier total dry thickness shall be in accordance with air barrier manufacturer published literature. Refer to the Air Barrier Manufacturer Technical Data Sheet.

3.4 FIELD QUALITY CONTROL

A. Final Observation and Verification:

1. Final inspection of fluid applied membrane air barrier assembly shall be carried out by the Owner's representative, the contractor, and the air barrier manufacturer representative.
2. Contact the air barrier manufacturer for warranty issuance requirements.

B. Fluid applied membrane air barrier assembly is not designed for permanent UV exposure. Refer to the air barrier manufacturer published literature for product limitations.

3.5 CLEANING

A. Promptly as the work proceeds, and upon completion, clean up and remove from the premises all rubbish and surplus materials resulting from the foregoing work.

B. Clean soiled surfaces, spatters, and damage caused by the installation.

C. Check area to ensure cleanliness and remove debris, equipment, and excess material from the site.

END OF SECTION

SECTION 07410 - PREFORMED METAL WALL PANELS

PART 1 - GENERAL

1.1 DESCRIPTION:

A. Work described in this section includes preformed metal wall system complete with clips, perimeter and penetration flashing, closures, and downspouts. They are to be provided by and warranted by the roof manufacturer.

B. Wall panels are to be attached as shown as shown on the drawings. This specification includes wall panels over framing on solid substrates.

C. Wall panels are to be installed in conjunction with all modified bitumen roofing systems and edge systems specified elsewhere

1.2 RELATED SECTIONS.

A. Drawings and general provisions of the Contract, including General Supplementary Conditions and Specification Sections apply to this section.

1.3 SUBMITTALS:

A. Shop drawings: Show wall system with flashings and accessories in plan and elevation; sections and details. Include metal thickness' and finishes, panel lengths, joining details, anchorage details, flashings and special fabrication provisions for termination and penetrations; existing beam locations, purlin and girt locations, thermal expansion provisions and special supports. Indicate relationships with adjacent and interfacing work. Shop drawings must be completed by the metal panel manufacturer's engineering department. Any and/or all changes recommended by the successful bidder must be approved by the manufacturer in writing prior to submittal.

B. Product Data: Include manufacturer's detailed material and system description, sealant and closure installation instructions, engineering performance data and finish specifications.

C. Color samples for initial color selection from the manufacturer's standard colors

C. Design test reports:

1. Independent laboratory testing report for system design load and seam integrity.

2. Professional engineer's documentation that panel system incorporates sufficient allowance for stress and movement.

3. A letter from an officer of the manufacturing company certifying that the materials furnished for this project are the same as represented in tests and supporting data.

4. Manufacturer's verifications that the panels are factory roll formed.

5. ASTM E108 or similar evidence of Class A Fire Resistance

6. ASTM E283 Test results must clearly demonstrate compliance with the performance requirements specified in article 1.9.ASTM E331 Test Report

7. ASTM E330 Test results must clearly demonstrate compliance with the performance requirements specified in article 1.9.

8. ASTM E331 Test results must clearly demonstrate compliance with the performance requirements specified in article 1.9.

1.4 INSTALLER QUALIFICATIONS:

A Engage an experienced metal roofing contractor (erector) to install metal wall system who has a minimum of three (3) years experience specializing in the installation of structural standing seam metal roof systems.

B Contractor must be certified by manufacturer specified as supplier of wall panel system and obtain written certification from manufacturer that installer is approved for installation of specified system. If requested, contractor must supply owner with a copy of this certification.

C. Successful contractor is required to maintain a full-time supervisor/foreman who is on the job-site at all times during installation of new roof system. Foreman must have a minimum of five (5) years experience with the installation of system similar to that specified.

D. Successful contractor must obtain all components of roof system from a single manufacturer including any roll good materials if required. Any secondary products that are required which cannot be supplied by the specified manufacturer must be recommended and approved in writing by primary manufacturer prior to bidding.

E. If required, fabricator/installer shall submit work experience and evidence of adequate financial responsibility. The owners representative reserves the right to inspect fabrication facilities in determining qualifications.

1.5 MANUFACTURERS QUALIFICATIONS / ALTERNATE MANUFACTURERS:

A. The materials outlined in the Material and Method Specifications are the type of materials to be used on this project. Bidder will not be allowed to supply panels formed at the job-site on portable rollformers; metal panels must be pre-manufactured and engineered for this project. Bidder will not be allowed to change materials after the bid opening date. If the bidder wishes to propose an alternate manufacturer and/or material than that specified, the following manufacturer criteria must be submitted with the bid.

1. Submit certified test reports from a testing laboratory that bear the stamp of a registered P.E. to show compliance with specified performance criteria.
2. Tests shall have been made for identical systems within the ranges of specified performance criteria.
3. Empirical calculations for roof performance shall only be acceptable for positive loads.
4. Indicate fastener types and spacings and provide fastener pullout values.
5. A list of a minimum of five (5) jobs where the proposed alternate material was used under similar conditions. The reference list shall include date of project, size of project, address and contact telephone number.

6. A written statement from the manufacturer stating that they will provide the building owner with a daily site inspection for a minimum of one (1) hour by an experienced, full time employee of the company.
7. A copy of manufacturer's warranty covering both material and labor.

B. The following samples must be submitted by alternate manufacturers:

1. Submit sample of panel section, at least 6" x 6" showing seam profile and also a sample of color selected.
2. Submit sample of panel clip.
3. Submit sample of purlin (Z) and/or bearing plate.
4. Submit sample of base sheet, roll goods and/or mastics.

1.6 DELIVERY, STORAGE, AND HANDLING:

A. Manufacturer's responsibility:

1. Protect components during fabrication and packing from mechanical abuse, stains, discoloration, and corrosion.
2. Provide protective interleaving between contact areas of exposed surfaces to prevent abrasion during shipment, storage, and handling.

B. Installer's responsibility:

1. Store materials off ground providing for drainage; under cover providing for air circulation; and protected from wind movement, foreign material contamination, mechanical damage, cement, lime or other corrosive substances.
2. Handle materials to prevent damage to surfaces, edges and ends of roofing sheets and sheet metal items. Damaged material shall be rejected and removed from the site.
3. Protect panels from wind-related damages.
4. Inspect materials upon delivery. Reject and remove physically damaged or marred material from project site.

1.7 JOB CONDITIONS:

A. Determine that work of other trades will not hamper or conflict with necessary fabrication and storage requirements for preformed metal roofing system.

B. Protection:

1. Provide protection or avoid traffic on completed roof surfaces.
2. Do not overload roof with stored materials.
3. Support no roof-mounted equipment directly on roofing system.

C. Ascertain that work of other trades which penetrates the wall or is to be made watertight by the wall panel is in place and approved prior to installation of roofing.

1.8 DESIGN AND PERFORMANCE CRITERIA:

A. Thermal Expansion and Contraction:

1. Completed metal wall panel and flashing system shall be capable of withstanding expansion and contraction of components caused by changes in temperature without buckling, producing excess stress on structure, anchors or fasteners, or reducing performance ability.

2. The design temperature differential shall be not less than 200 °F.

3. Interface between panel and clip shall provide for unlimited thermal movement in each direction along the longitudinal direction.

B. Uniform wind load capacity:

1. Installed wall panel system shall withstand negative design wind loading pressures complying with the following criteria. Anchor clips shall be installed exactly as spacing given in article 3.0.

   a. Design Code: ASCE 7-10, Method 2 for Components and Cladding.
   b. Safety Factor: 1.650 after any load reduction or material stress increase.
   c. Category III Building with an Importance Factor of 1.15.
   d. Wind Speed: 120 mph.
   e. Exposure Category: C
   g. Wall Height: as shown on Drawings

2. Capacity shall be determined using uniform static air pressure method in accordance with ASTM E330. Allowable safe working loads shall be determined by dividing the ultimate test load by the safety factor specified above.

C. ASTM E283: Static pressure air infiltration (doors, windows, curtain walls):

1. Pressure Leakage Rate

   a. 1.57 PSF 0.0033 cfm/sq.ft.
   b. 6.24 PSF 0.0056 cfm/sq.ft.
   c. 12.0 PSF 0.062 cfm/sqft.
   d. 15.0 PSF 0.064 cfm/sqft
   e. 20.0 PSF 0.074 cfm/sq.ft.

D. ASTM E331: Static pressure water infiltration (doors, windows, curtain walls):

Pressure Result:
5 Gal./Hr. per S.F. and Static No Leakage
Pressure of 20.0 Psf for 15 minutes.

1.10 WARRANTIES:

A. Owner shall receive one (1) warranty from manufacturer of roof and wall panels covering all of the following criteria. Multiple warranties are not acceptable.

1. Manufacturer's 30 year limited watertight warranty.

2. 20 year coverage on finish including checking, crazing, peeling, chalking, fading and/or adhesion.
3. 20 year material coverage.
4. Installer shall provide manufacturer with 2 year warranty covering roofing system installation and watertightness.
5. Warranties shall commence on date of Final Acceptance

PART 2 PRODUCTS

A. METAL WALL PANEL SYSTEM:

1. Whenever a particular make of material, trade name and/or manufacturer's name is specified herein, it shall be regarded as being indicative of the minimum standard of quality required. A bidder who proposes to quote on the basis of an alternate material and/or system will only be considered if the proposed alternate is submitted on time and is documented as being equivalent or superior in quality to the specified system as described in these specifications. Additionally, all manufacturer and contractor fabricator guidelines must be met as specified.

    a) Roofing Material Manufacturer
    b) Or approved equal.

2. Manufacturer's names are listed herein to establish a standard. Any proposed substitutions must be submitted in accordance with Specification Section 01300. These products and complete system must be of equal or better quality than the features specified herein, will serve with equal efficiency and dependability, and satisfy the purpose for which the items specified were intended.

B. WALL PANEL MATERIAL

1. Panel material: 24 gauge galvalume coated steel, type AZ-55, grade 50 B smooth as per ASTM A792-96.

2. Flashing and flat stock material: Fabricate in profiles indicated on drawings of same material, thickness, and finish as roof system, unless indicated otherwise.

3. Nominal width 12" for wall panel.

C. Finish on surfaces:

1. Exposed surfaces for coated steel:

    a. Two coat coil applied, baked-on full-strength (70% resin) fluorocarbon coating system (polyvinylidene fluoride, PVF2), applied by manufacturer's approved applicator.
    b. Coating system shall provide nominal 1.0 mil dry film thickness, consisting of primer and color coat.

c. Provide a post coated clear coat application to protect against fade, chalking and other discoloration.

d. Color shall be selected by the Owner / Architect from manufacturer's standard or premium colors.

D. Characteristics:

1. Fabricationtion: : Panels shall be factory roll-formed from the specified metal. Field rolled panels will not be allowed.

2. Configuration: Interlocking flush/flat seams incorporating concealed anchor clips. Through fastened or exposed fastener systems are not acceptable.

3. Panel seam legs shall be one and one half (1 1/2) inch nominal concealed depth behind the panel face. Seam shall allow for expansion and contraction of panels due to thermal changes.

4. Anchor clips: Clips shall be 22 gauge galvalume steel designed to allow thermal movement of the panel in each direction along the longitudinal dimension.

5. Panel Width (Seam Spacing): 12" nominal.

6. Panel lengths: Full length without joints to the extent as is practical.

7. Stiffening ribs, mesas: Located in flat of panel to minimize oil canning and telegraphing of structural memebers.

E. Accessories:

1. Fasteners:

a. Concealed fasteners: Corrosion resistant steel screws, #10 x 1" long, pancake head, Phillips drive. Use self-drilling, self-tapping for metal substrate.

b. Exposed fasteners: Series 410 stainless steel screws or one eighth (1/8) inch diameter stainless steel waterproof rivets. All exposed fasteners shall be factory painted to match the color of the wall panels.

2. Underlayment: Provide water resistive barrier installed behind wall panels system as recommended by metal panel manufacturer:

a. Intelliwrap SA (or approved equal): 3-layer, self-adhering, 25 mil watertight and vapor permeable air and water barrier membrane.

b. SA Primer: a polymer emulsion based primer used to improve adhesion of self-adhered membranes to various building substrates.

3. Provide all miscellaneous accessories for complete installation.

F. Finish on surfaces:

1. Exposed surfaces for coated steel:

a. Two coat coil applied, baked-on full-strength (70% resin) fluorocarbon coating system (polyvinylidene fluoride, PVF2), applied by manufacturer's approved applicator.
b. Coating system shall provide nominal 1.0 mil dry film thickness, consisting of primer and color coat.
c. Provide a post coated clear coat application to protect against fade, chalking and other discoloration.
d. Color shall be selected by the Owner / Architect from manufacturer's standard or premium colors.

PART 3 EXECUTION

3.1 PREPARATION

A. Completely remove existing panels and subframing before beginning with installation. Inspect the walls to verify integrity. Install hat sections coplaner and plum on walls. Bring any areas of deterioration to the Architect's attention. Repair or replace existing wall surface as needed.

3.2 WALL PANEL INSTALLATION.

A. All details will be shown on manufacturer's shop drawings to successful bidder; install panels and flashings in accordance with approved shop drawings and manufacturer's product data, within specified erection tolerances.

B. Prepare wall for the installation of panels, including:

1. Install continuous underlayment membrane required by roofing system manufacturer.

a. Apply SA Primer to wall surface at 1/3 to ½ gallon per 100 sq. ft., allow minimum 2 hours to dry tack-free. Surface must be covered within 48 hours or re-primed.

b. Seal openings or cracks greater than ¼" with Intelliwrap Multiband adhesive tape

c. Install Intelliwrap SA membrane over substrate. Position membrane on wall and remove split-release liner to adhere to substrate. Ensure full contact of membrane to wall surface and seal lap between courses of membrane.

2. Install intermediate hat sections no more than 24" on center. Attach hat sections with expanding masonry anchors, 24" on center staggered (12" between top and bottom rows) and anchors at both top and bottom flange at ends of hat sections.

C. Directly over the framing system, install metal wall panels. All panels will be fastened into the hat sections with concealed anchor at 24" o.c. maximum spacing along each panel seam.

D. Seal laps and joints in accordance with roofing system manufacturer's product data.

E. Coordinate flashing and sheet metal work to provide weathertight conditions at panel terminations. Fabricate and install in accordance with SMACNA Manual standards.

F. Installed system shall be true to line and plane and free of dents, and physical defects. In light gauge panels with wide flat surfaces, some oil canning may be present. Oil canning does not affect the finish or structural integrity of the panel and is therefore not cause for rejection.

G. Form joints in linear sheet metal to allow for 1/4" minimum expansion at 20'-0" o.c. maximum and 8'-0" from corners.

H. At joints in linear sheet metal items, set sheet metal items in two 1/4" beads of butyl sealant. Extend sealant over all metal surfaces. Mate components for positive seal. Allow no sealant to migrate onto exposed surfaces.

I. Remove damaged work and replace with new, undamaged components.

J. Touch up exposed fasteners using paint furnished by wall panel manufacturer and matching exposed panel surface finish.

K. Clean exposed surfaces of panels and accessories after completion of installation. Leave in clean condition at date of substantial completion. Touch up minor abrasions and scratches in finish.

3.3 CLEANING AND PROTECTION:

A. Remove protective film (if any) from exposed surfaces of metal wall panels, promptly upon installation. Strip with care to avoid damage to finishes. Clean exposed surfaces of wall panels and accessories after completion of installation. Leave in clean condition at date of substantial completion. Touch up minor abrasions and scratches in finish.

B. Provide final protection in a manner acceptable to installer, which ensures metal wall panels being without damage or deterioration at time of substantial completion.

C. Touch up exposed fasteners using paint furnished by metall wall panel manufacturer and matching exposed panel surface finish.

END OF SECTION

SECTION 07552 - MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. The Contractor will use the system described under Part 2 product section to ensure the physical characteristics of the submitted product meet the requirements of the specification.

1.2 SUMMARY

A. This Section includes the following:

1. Two-ply, modified bituminous membrane roofing system.
2. Cold-applied 80 mil SBS base sheet and 160 mil mineral surfaced modified surface membrane
3. Roof expansion assemblies.
4. Roofing insulation: Polyisocyanurate, uniform thickness and tapered system as indicated on project drawings for enhanced drainage and crickets. Gypsum fiber cover board.
5. Roof membrane surfacing.
6. Roof flashings and counter flashings.
7. Walkways.

1.3 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D 1079 for definitions of terms related to roofing work not otherwise defined in this Section.

1.4 PERFORMANCE REQUIREMENTS

A. General: Install a watertight, modified bituminous membrane roofing and base flashing system with compatible components that will not permit the passage of liquid water and will withstand wind loads, thermally induced movement, and exposure to weather without failure.

1. Uniform Wind Uplift Load Capacity
   a. Installed roof system shall withstand negative (uplift) design wind loading pressures complying with the following criteria.
      1) Design Code: ASCE 7-16, Method 2 for components and cladding.
      2) Importance Factor: III
      3) Wind Speed: 120 mph
      4) Exposure Category: C
      5) Roof Pitch: 1/4:12
2. Enhanced fastening patterns as described in 3.4G apply to the roof zones for each roof section. Zone widths are as described below:
      1) Zones 1 and 2: 9' width

Zone 3: 3' width, 9' length

3. Live Load: 20 psf, or not to exceed original building design
4. Dead Load: Installation of new roofing materials shall not exceed the dead load capacity of the existing roof structure.

1.5 SUBMITTALS

A. Product Data: For each type of roofing product specified. Include data substantiating that materials comply with requirements.

B. Shop Drawings: Include plans, sections, details, and attachments to other work, for the following:

1. Base flashings, cants, and membrane terminations.
2. Tapered insulation, including slopes.
3. Crickets, saddles, and tapered edge strips, including slopes.

C. Samples for Verification: Of the following products:

1. 12-by-12-inch (300-by-300-mm) square of modified bituminous, smooth-surfaced cap sheet and all base sheets.
2. 12-by-12-inch (300-by-300-mm) square of roofing insulation.
3. 12-by-12-inch (300-by-300-mm) square of walkway pads.
4. 6 insulation fasteners of each type, length, and finish.
5. Flashing and counter flashing.

D. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install specified roofing system and is eligible to receive the no dollar limit roofing manufacturer's warranty.

E. Manufacturer Certificates: Signed by roofing system manufacturer certifying that the roofing system complies with requirements specified in the "Performance Requirements" Article. Upon request, submit evidence of complying with requirements.

F. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

G. Product Test Reports: Based on evaluation of tests performed by manufacturer and witnessed by a qualified independent testing agency, indicate compliance of components of roofing system with requirements based on comprehensive testing of current product compositions.

H. Research/Evaluation Reports: Evidence of roofing system's compliance with building code in effect for Project from a model code organization acceptable to authorities having jurisdiction.

I. Maintenance Data: For roofing system to include in the maintenance manuals specified in Division 1.

J. Warranty: Sample copy of no dollar limit roofing manufacturer's warranty stating obligations, remedies, limitations, and exclusions of warranty.

K. Inspection Report: Copy of roofing system manufacturer's inspection report and/or a qualified independent testing agency's report of completed roof installation.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer to perform Work of this Section who has specialized in installing roofing similar to that required for this Project; who is approved, authorized, or licensed by the roofing system manufacturer to install manufacturer's product; and who is eligible to receive the no dollar limit roofing manufacturer's warranty.

B. Fire-Test-Response Characteristics: Provide roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method indicated below by UL, FM, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Exterior Fire-Test Exposure: Class A; complying with ASTM E 108, for application and slopes indicated. (Fire rated sheet).

C. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site. Meet with the same participants and review the same items listed for the pre-installation conference. In addition, review status of submittals and coordination of work related to roof construction. Notify participants at least 5 working days before conference.

D. Pre-installation Conference: Before installing roofing system, conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings." Notify participants at least 5 working days before conference.

1. Meet with Owner; Architect; Owner's insurer, if applicable; testing and inspecting agency representative; roofing installer; roofing system manufacturer's representative; deck installer; and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods of removing the existing roofing and insulation. Examine existing roof deck structure, slope and area of replacing roofing for daily output.
3. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and attachment to structural members.
5. Review loading limitations of deck during and after roofing.
6. Review flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing.
7. Review governing regulations and requirements for insurance, certifications, and inspection and testing, if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

10. Document proceedings, including corrective measures or actions required, and furnish copy of record to each participant.
11. Review all roofing openings, sizes, location, curb or post supports.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store roofing materials in a dry, well-ventilated, weather tight location to ensure no significant moisture pickup and maintain at a temperature exceeding roofing system manufacturer's written instructions. Store rolls of felt and other sheet materials on end on pallets or other raised surfaces. Do not double-stack rolls.

1. Handle and store roofing materials and place equipment in a manner to avoid significant or permanent damage to deck or structural supporting members.

B. Do not leave unused felts and other sheet materials on the roof overnight or when roofing work is not in progress unless protected from weather and moisture and unless maintained at a temperature exceeding 50 deg F (10 deg C).

C. Deliver and store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer.

D. Protect roofing insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

1.8 PROJECT CONDITIONS

A. Weather Limitations: Proceed with roofing work only when existing and forecasted weather conditions permit roofing to be installed according to manufacturers' written instructions and warranty requirements.

1.9 WARRANTY

A. General Warranty: The warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. No Dollar Limit Roofing Manufacturer's Warranty: Submit a written warranty including roof insulation and all copings and edge metal, without monetary limitation, signed by roofing system manufacturer agreeing to promptly repair leaks in the roof membrane and base flashings resulting from defects in materials or workmanship for the following warranty period. Warranty shall also include a 90 miles per hour wind warranty:

1. Warranty Period: 30 years Edge to Edge.
2. Must include all metal roofing and edge components.

C. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering Work of this Section, including membrane

roofing, base flashing, roofing insulation, fasteners, and vapor retarders, if any, for the following warranty period:

1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 Modified Built Up Roof System:

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. SBS Modified Bituminous Base Sheet:
Garland Co., Inc. Basis of Design Approved equal substitutions will be considered in accordance with Specification Section 01300-Submittals.

2. Other manufactures approved based on compliance with the specification:
Tremco
Approved equal.

2.2 Modified Built Up Roof System Base Sheet

A. Base Ply of Field System: SBS modified bituminous sheet (Styrene-Butadiene- Styrene) 80 mil, smooth surfaced rubber modified roofing membrane reinforced with a dual fiberglass scrim.

1. Use: Base ply of 2-ply, modified bituminous membrane roofing system.
2. Reinforcing: Fiberglass.
3. Finish: smooth and sanded

B. Physical Properties: Provide SBS -modified bituminous membrane materials with the following properties when tested according to ASTM D 5147:

1. Thickness: 80 mils minimum.
2. Tensile Strength: 225 bf/in. at 73.4 deg F (MD). 225 lbf/in. at 73.4deg F (CMD).
3. Elongation at Maximum Load: 7 percent minimum at 73.4 deg F in each direction.
4. Tear Strength: 300 lbf. at 73.4 deg. F (MD). 300 lbf. at 73.4 deg. F (CMD).
5. Low-Temperature Flexibility: Pass at minus 30 deg F.

C. Base Ply of Flashing System: SBS modified bituminous sheet (Styrene-Butadiene-Styrene) 40 mil, smooth surfaced rubber modified roofing membrane reinforced with a dual fiberglass mat.

1. Use: Base ply of 2-ply, modified bituminous membrane flashing system.
2. Reinforcing: fiberglass.
3. Finish: smooth

D. Physical Properties: Provide SBS -modified bituminous membrane materials with the following properties when tested according to ASTM D 5147:

1. Thickness: 40 mils minimum.
2. Tensile Strength: 215 bf/in. at 73.4 deg F (MD). 215 lbf/in. at 73.4deg F (CMD).
3. Elongation at Maximum Load: 4.5 percent minimum at 73.4 deg F in each direction.
4. Tear Strength: 275 lbf. at 73.4 deg. F (MD). 275 lbf. at 73.4 deg. F (CMD).
5. Low-Temperature Flexibility: Pass at minus 30 deg F.

2.3 Modified Built Up Roof System Cap Sheet

A. SBS/SIS modified bituminous sheet (Styrene-Isoprene-Styrene/Styrene-Butadiene-Styrene) 160 mil, bio based mineral surfaced rubber modified roofing membrane reinforced with a dual fiberglass and polyester scrim mat.

1. Use: Roof membrane.
2. Use: Finish ply of 2-ply, modified bituminous membrane roofing system.
3. Reinforcing: Polyester and fiberglass.
4. Finish: light grey mineral

B. Physical Properties: Provide SBS/SIS-modified bituminous membrane materials with the following properties when tested according to ASTM D 5147:

1. Thickness: 160 mils minimum.
2. Tensile Strength: 500 lbf/in. at 73.4 deg F (MD). 550 lbf/in. at 73.4deg F (CMD).
3. Elongation at Maximum Load: 6.0 percent minimum at 73.4 deg F in each direction.
4. Tear Strength: 900 lbf. at 73.4 deg. F (MD). 950 lbf. at 73.4 deg. F (CMD).
5. Low-Temperature Flexibility: Pass at minus 40 deg F.
6. Bio-based Content: 2.5%

2.4 Modified Adhesives and Mastics

A. Cold Applied Membrane Adhesive: V.O.C. compliant ASTM D3019. Performance Requirements:
1. Non-Volatile Content ASTM D4479 70%
2. Density ASTM D1475 8.9 lbs./gal. (0.9kg/l)
3. Viscosity Stormer ASTM D562 400-500 grams
4. Flash Point ASTM D93 100°F min. (37°C)
5. Slope: up to 3:12

B. Brush Grade Flashing Adhesive

1. Performance Requirements:
2. Non-Volatile Content ASTM D4479 70% min.
3. Density ASTM D1475 8.6 lbs./gal. (1kg/l)
4. Flash Point ASTM D93 100°F (37°C)

C. Silver Asphalt Roofing Mastic: V.O.C. compliant,

1. Flash Point ASTM D93 >100 °F.

2. Density @ 77°F 8.3 lbs. /gal
3. Non-Volatile 70% min.
4. Viscosity @ 77 °F mobilometer 1500g 9-11 seconds
5. Reflectivity: 60%
6. Post Industrial Recycled Content 5.19%

2.5 AUXILIARY MEMBRANE MATERIALS

A. General: Furnish auxiliary materials recommended by roofing system manufacturer for intended use and compatible with SBS-modified bituminous roofing.

1. Furnish liquid-type auxiliary materials that meet VOC limits of authorities having jurisdiction.

B. Asphalt Primer: ASTM D 41 - VOC compliant.

C. Asphalt Roofing Cement: ASTM D 2822, asbestos free, VOC compliant as provided by the Membrane manufacturer and silver in color throughout the thickness

D. Mastic Sealant: Polyisobutylene, plain or modified bituminous, nonhardening, nonmigrating, nonskinning, and nondrying.

E. Fasteners: Factory-coated steel fasteners and metal plates complying with corrosion-resistance provisions of FM 4470; designed for fastening base sheets, base-ply felts, and base flashings and for backnailing modified bituminous membrane to substrate; tested by manufacturer for required pullout strength; and acceptable to roofing system manufacturer.

F. Wood Nailer Strips: Furnish wood nailer strips complying with requirements of Division 6 Section "Rough Carpentry."

G. Cants: Wood Fiber Cants

H. Urethane Sealant: One part, non-sag sealant as recommended and furnished by the membrane manufacturer for moving joints.

1. Tensile Strength (ASTM D412)225 psi
2. Elongation (ASM D412)450%
3. Hardness, Shore A (ASTM C920)25-35
4. Bond Durability – Class 25 (ASTM C920)Passes

I. Pitch Pocket Sealer: Use Liquid Flashing in lieu of pitch pockets wherever practical. Where pitch pockets are needed, use specified Liquid Flashing product to fill pitch pockets.

J. Pitch pans, Rain Collar 24 gauge stainless or 20oz (567gram) copper. All joints should be welded/soldered watertight. See details for design

K. Drain Flashings should be 4lb (1.8kg) sheet lead formed and rolled

L. Plumbing stacks should be 4lb (1.8kg) sheet lead formed and rolled.

M. Miscellaneous Accessories: Provide miscellaneous accessories recommended by roofing system manufacturer for intended use.

N. Rust Inhibitive Paint: As recommended and furnished by the membrane manufacturer for mechanical units and other metal surfaces to control and prevent surface rust.

O. Energy Star Acrylic Surfacing: Pyramic Plus LO; For use on all liquid flashing details. Energy Star approved white acrylic roof coating ASTM G26 with 81% reflectivity, 250% Minimum elongation and 250 psi tensile strength.

1. Weight/Gallon 12 lbs./gal. (1.44 g/cm3)
2. Non-Volatile % (ASTM D 1644) 66 min

P. Liquid Flashing: A two-component, asphaltic-polyurethane, low odor, liquid flashing material designed for specialized details unable to be waterproofed with typical modified membrane flashings. Must be painted when cured.

1. Tensile Strength (ASTM D412) 650 psi
2. Elongation (ASTM D412) 325%
3. Density @77°F 8.3 lb/gal typical

Q. Non-obstructive Factory Fabricated Elastomeric Expansion Joint: As recommended and approved by Roof System Manufacturer, provide Situra Redline or approved equal.

2.7 INSULATION MATERIALS

A. General: Provide preformed, roofing insulation boards that comply with requirements, selected from manufacturer's standard sizes and of thicknesses indicated.

1. Provide roof insulation as indicated on project drawings and according to approved tapered insulation shop drawing:

a. Uniform thickness insulation where indicated
1) Thickness of insulation to be as noted in roof plans. Provide standard thickness of 5" (2 layers of 2.6"), however refer to roof plan for variations as dictated by site conditions.

2. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated. All crickets shall be constructed using ½:12 tapered insulation.

3. Provide 4' wide initial course of ½:12 tapered insulation along gutter edge for enhanced drainage.

B. Polyisocyanurate Board Insulation: Rigid, cellular Polyisocyanurate thermal insulation with core formed by using HCFCs as blowing agents complying with ASTM C 1289, classified by facer type as follows:

1. Facer Type: Type II, felt or glass-fiber mat on both major surfaces.

C. Gypsum Cover Board

1. Securock Roof Board:
   a. Uniform composition, non-combustible, water resistant gypsum fiber panel.
   b. Board size: 4' x 4'
   c. Thickness: Minimum ½".

2.8 INSULATION ACCESSORIES

A. General: Furnish roofing insulation accessories recommended by insulation manufacturer for intended use and compatible with sheet roofing material.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions of FM 4470, designed for fastening roofing insulation to substrate, tested by manufacturer for required pullout strength, and acceptable to roofing system manufacturer.

C. Tapered Edge Strips: Rigid, cellulosic-fiber insulation board, complying with ASTM C 208, Type 2.

D. Insulation Board Adhesive: Two component, foam adhesive as recommended by roof manufacturer and approved by FM indicated ratings.
1. Tensile Strength (ASTM D412) 250 psi
2. Density (ASTM D1875) 8.5 lbs./gal.
3. Viscosity (ASTM D2556) 22,000 to 60,000 cP.
4. Peel Strength (ASTM D903) 17 lb/in.
5. Flexibility (ASTM D816) Pass @ -70°F

2.9 ROOF WALKWAYS

A. Walkway Pads: Factory formed recycled rubber, nonporous, with a slip-resisting surface texture, manufactured specifically for adhering to modified bituminous membrane roofing as a protection course for foot traffic, of the following thickness:

1. ¾" thick for use in high traffic areas
2. Products: Subject to compliance with requirements, provide one of the following:
   a. Supplied by membrane manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions under which roofing will be applied, with Installer present, for compliance with requirements.

B. Verify that roof openings and penetrations are in place and set and braced and that roof drains are properly clamped into position.

C. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at roof penetrations and terminations and match the thicknesses of insulation required.

1. Verify that wood nailer strips are located perpendicular to roof slope and are spaced according to requirements of roofing system manufacturer.

D. Verify that flatness and fastening of metal roof decks comply with installation tolerances specified in Division 5 Section "Steel Deck."

E. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units in excess of 1/16 inch (1.5 mm) out of plane.

F. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, and other substances detrimental to roofing installation per roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Inspect the deck to verify integrity. Bring any areas of questionable integrity to the Construction Manager's attention. Do not cover any areas of questionable welds or deck out of plane.

D. Metal Deck

1. Fastening of the deck should comply with the anticipated live and dead loads pertaining to the building as well as applicable Code.
2. Steel decks shall be minimum 22-gauge factory galvanized or zinc alloy coated for protection against corrosion.
3. Suitable insulation shall be mechanically attached as recommended by the insulation manufacturer.
4. Decks shall comply with the gauge and span requirements in the current Factory Mutual FM Approval Guide and be installed in accordance with Loss Prevention Data Sheet 1-28 or specific FM approval.
5. When re-roofing over steel decks, surface corrosion shall be removed, and repairs to severely corroded areas made. Loose or inadequately secured decking shall be fastened, and irreparable or otherwise defective decking shall be replaced.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install modified bituminous membrane roofing system according to roofing system manufacturer's written instructions and applicable recommendations of NRCA/ARMA's "Quality Control Recommendations for Polymer Modified Bitumen Roofing."

1. Install roofing system according to applicable specification plates of NRCA's "The NRCA Roofing and Waterproofing Manual."

B. Start installation of modified bituminous membrane roofing in presence of roofing system manufacturer's technical personnel.

C. Shingling Plies: Install modified bituminous membrane roofing system with ply sheets shingled uniformly. Shingle in direction to shed water.

1. Where roof slope exceeds 1/2 inch per 12 inches (1:24), run sheets of modified bituminous membrane roofing parallel with slope. Backnail top ends of sheets to nailer strips.

D. Cant Strips: Install and secure preformed 45-degree cant strips at junctures of modified bituminous membrane roofing system with vertical surfaces or angle changes greater than 45 degrees.

E. Cooperate with inspecting and testing agencies engaged or required to perform services for installing modified bituminous membrane roofing system.

F. Coordinate installing roofing system components so insulation and roofing plies are not exposed to precipitation or left exposed at the end of the workday or when rain is forecast.

1. Provide cutoffs at end of each day's work to cover exposed ply sheets and insulation with a course of coated felt with joints and edges sealed.
2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
3. Remove and discard temporary seals before beginning work on adjoining roofing.

G. Substrate-Joint Penetrations: Prevent roofing adhesives from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

3.4 INSULATION INSTALLATION

A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with roofing system manufacturer's written instructions for installing roofing insulation.

C. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

D. Install one or more layers of insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 3 inches or greater, install required

thickness in 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.

F. Install insulation with long joints of insulation in continuous straight lines with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.

1. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.

H. Mechanically attach insulation to metal deck. The fastening pattern shall be 11 fasteners in Zone 1 and 1', 17 in Zone 2 and 22 in Zone 3. The zone width is a minimum of .6 multiplied by the height of the building. Refer to section 1 for roof zone descriptions.

I. Install subsequent layers of insulation in ¾" beads of urethane insulation adhesive. Insulation adhesive spacing shall be 12" on center in Zone 1 and 1', 8" on center in Zone 2, and 4" on center in Zone 3.

J. All crickets will be fabricated from ½" tapered insulation set in insulation adhesive, following the prescribed pattern for each zone of the roof.

L. Adhere one layer of 1/2" gypsum board insulation to the finished tapered or uniform thickness polyisocyanurate in insulation adhesive, following the prescribed pattern for each zone of the roof. Stagger all joints.

M. Provide relief cuts in boards to ensure full contact with urethane adhesive. Utilize temporary weights on corners, weighted rollers, or other means as needed to achieve complete bond and flush surface across the roof prior to roofing installation.

3.5 BASE PLY INSTALLATION

A. The modified base ply shall be solidly bonded to the cover board with cold adhesive at the rate of 2 – 2.5 gallons per 100 sq. ft.

B. The roll must push a puddle of adhesive in front of it with asphalt slightly visible at all side laps. Care should be taken to eliminate air entrapment under the membrane. Broom sheets or utilize rollers to engage adhesive and eliminate wrinkles or air pockets.

C. Subsequent rolls of modified shall be installed across the roof as above with a minimum of 4" side laps and 8" end laps. The end laps shall be staggered.

D. Extend membrane to the top edge of all cants in full mopping of asphalt and to the top outside edge of parapet walls / curbs as shown on the drawings.

E. Seal-off all horizontal edges of membrane with reinforcing membrane fabric embedded in a base course of roofing mastic.

3.6 SURFACE MEMBRANE APPLICATION

A. The surface membrane shall be solidly bonded to the base layer with cold adhesive at the rate of 2-2.5 gallons per 100 sq. ft.

B. The roll must push a puddle of adhesive in front of it. Care should be taken to eliminate air entrapment under the membrane or wrinkles in the membrane.

C. Subsequent rolls of modified shall be installed across the roof as above with a minimum of 4" side laps and 8" end laps. The end laps shall be staggered. The modified membrane shall be laid in the same direction as the base ply, but the laps shall not coincide with the laps of the base layers.

D. Extend membrane to the top edge of all cants in full application of adhesive and to the top outside edge of parapet walls / curbs as shown on the drawings.

E. Granulate all bleed out of adhesive at seams.

F. Aesthetics will be a punch list item. The roof must match the owner's standards for appearance.

3.7 FLASHING AND STRIPPING INSTALLATION

A. All curb, wall and parapet flashings shall be sealed with an application of mastic and mesh on a daily basis. No condition should exist that will permit moisture entering behind, around, or under the roof or flashing membrane.

B. Prepare all walls, penetrations and expansion joints to be flashed and where shown on the drawings, with asphalt primer at the rate of .75 to one gallon per square. Allow primer to dry tack free.

C. The 40 mil SBS modified will be used as the flashing membrane and will be adhered to the primed substrate with flashing grade cold adhesive and nailed off on the outside vertical face of the parapet wall or to the top of the curb. The entire flashing membrane system must be solidly adhered to the substrate. This will be inspected prior to surface membrane installation for compliance. Base flashing should be applied each day after application of the base ply in the field.

D. The field surface membrane will be used as the top flashing ply. It shall be solidly adhered to the based flashing ply with 2 gallons per square of brush grade flashing adhesive .

E. Seal all vertical laps of flashing membrane with a three course application of Silver Flash and fiberglass mesh.

F. Secure top of flashing membrane with termination bar and fasten 8-inches o.c.. Flashing can be nailed to the top of all wood curbs with ring shanked nails.

G. Counter flashing, cap flashings, expansion joints, and similar work to be coordinated with modified bitumen roofing work are specified in other Sections.

H. Roof accessories, Miscellaneous sheet metal accessory items, including piping vents and other devices to be coordinated with modified bituminous roofing system work are in other Sections.

3.8 FLASHING MEMBRANE INSTALLATION (Specific)

A. Installation of Lead Toilet Sleeves

1. Run all plies over the field of roof. Seal the base of the stack with elastomeric sealant
2. Install new lead sleeves set in application of elastomeric sealant. Prime the flange of the new lead.
3. Strip in the flange with one ply of SBS Base flashing ply set in cold adhesive. A second ply of SBS/SIS membrane shall be cut so that the hole over the stack is smaller than the previous ply and set in cold adhesive.
4. Caulk the intersection of the membrane and the lead with elastomeric sealant.
5. Turn lead flashing a minimum of 1" down the inside of the pipe.

B. Expansion at Interface of New Construction and Existing Roofing

1. Install all components of the system in accordance with the manufacturer's instructions. The system is to be wholly encapsulated between the plies of the modified bitumen membrane in a roofing/waterproofing cold applied adhesive.
2. Slit the modified bitumen base ply with a knife along the joint gap. Refer to the manufacturer's instructions for the preparations and adhering of the Redline Joint. Install the prepared Redline to the substrate, making sure that the joint is firmly and uniformly set, without voids, into the cold adhesive. The Redline flange must be completely encapsulated in the asphalt/bitumen and a bitumen bead visible along Redline salvage edge.
3. Install the modified bitumen stripping plies smooth, free from air pockets, wrinkles, fish mouths, or tears. Install each stripping ply; shingle lap fashion, onto the Redline Joint firmly and uniformly, without voids. The flange must be completely encapsulated in the bitumen and a bitumen bead visible along the salvage edge.
4. Base ply shall be 18" minimum onto existing roof. Cap Ply shall extend 24" minimum (6" beyond base ply). Provide 3-course seal across leading edge of cap ply.
5. At all times observe modified roof system manufacturer's recommendations. Obtain approval from OEM roof system manufacturer (The Garland Company) at existing building roof for means and method of expansion joint installation.

C. Premanufactured Flashless Snap-On Metal Edge System

1. Position base ply of the Built-Up and/or Modified Roofing membrane over the roof edge covering nailers completely, fastening eight (8) inches on center. Install membrane and cap sheet with proper material and procedure according to manufacturer's recommendations. Cap sheet shall stop at the edge of the roof and shall not turn over the edge of the nailer.
2. Prior to installing the base anchor, assure a level plane is present. If not, shim the roof edge surface as required.
3. Extruded base anchor: Apply two 1/4" beads of Green-Lock Sealant XL or equal on the bottom surface of the top flange of the extruded anchor.
4. Set the extruded anchor on the edge and face fasten through pre-punched slots every 18 inches o.c. for 5.75 inch face fascia, and 18 inches o.c. staggered for any fascia size greater than 5.75 inches. Begin fastening 6 inches from ends.

5. Install Green-Lock Sealant XL or equal at the ends of the base frame to prevent water from running between base anchor joints.
6. Install compression seals every 40 inches on center in the slots located at the top of the extruded anchor.
7. Install fascia cover setting the top flange over the top flange and compression seals of the base anchor. Assure compression seals are in place during this process. Beginning on one end and working towards the opposite end, press downward firmly (do not rotate) until "snap" occurs and cover is engaged along entire length of miter.
8. Install splice plate at each end of the base anchor and fascia cover prior to the installation of the next adjacent ten foot piece.

E. Liquid Flashing Application

1. Mask target area on roof membrane with tape.
2. Clean all non-porous areas with isopropyl alcohol.
3. Apply 32 wet mil base coat of liquid flashing over masked area.
4. Embed polyester reinforcement fabric into the base coat of the liquid flashing.
5. Apply 48-64 wet mil top coat of the liquid flashing material over the fabric extending 2" past the scrim in all directions.
6. Apply minerals immediately or allow the liquid flashing material to cure 15-30 days and then install reflective coating

I. Expansion Joint

1. Minimum curb height is 8 inches (203 mm) above finished roof height. Chamfer top of curb. Prime vertical curb at a rate of 100 square feet per gallon and allow to dry.
2. Mechanically attach wood cant to expansion joint nailers. Run all field plies over cant a minimum of 2 inches (50 mm).
3. Install compressible insulation in neoprene cradle.
4. Install base flashing ply covering curb set in bitumen with 6 inches (152 mm) on to field of the roof.
5. Install a second ply of modified flashing ply in bitumen over the base flashing ply, 9 inches (228 mm) on to the field of the roof. Attach top of membrane to top of curb and nail at 8 inches (203 mm) o.c. Apply a three-course application of mastic and mesh at all vertical seams and allow to cure and aluminize.
6. Install pre-manufactured expansion joint cover. Fasten sides at 12 inches (609 mm) o.c. with fasteners and neoprene washers. Furnish all joint cover laps with butyl tape between metal covers.

J. Premanufactured Curb For Equipment Support

1. Minimum curb height is 8 inches (203 mm) above finished roof height. Provide manufacturer's liquid flashing in lieu of membrane at all curbs less than 8" above finished roof surface. Prime vertical at a rate of 100 square feet per gallon and allow to dry.
2. Run all field plies over cant of the pre-manufactured equipment support a minimum of 2 inches.
3. Install base flashing ply covering pre-manufactured curb with 6 inches (152 mm) on to field of the roof.

4. Install a second ply of modified flashing ply installed over the base flashing ply, 9 inches (228 mm) on to field of the roof. Attach top of membrane to top of wood curb and nail at 8 inches (203 mm) o.c. Apply a three-course application of mastic and mesh at all vertical seams and allow to cure and aluminize.
5. Install pre-manufactured cover. Fasten sides at 24 inches (609 mm) o.c. with fasteners and neoprene washers. Furnish all joint cover laps with butyl tape between metal covers.
6. Set equipment on neoprene pad and fasten as required by equipment manufacturer.

K. Curb Detail/Air Handling Unit

1. Minimum curb height is 8 inches (203 mm) above finished roof height. Provide manufacturer's liquid flashing in lieu of membrane at all curbs less than 8" above finished roof surface. Prime vertical at a rate of 100 square feet per gallon and allow to dry.
2. Set cant in bitumen. Run all field plies over cant a minimum of 2 inches (50 mm).
3. Install base flashing ply covering curb set in bitumen with 6 inches (152 mm) on to field of the roof.
4. Install a second ply of modified flashing ply in bitumen over the base flashing ply, 9 inches (228 mm) on to the field of the roof. Apply a three-course application of mastic and mesh at all vertical seams and allow to cure and aluminize.
5. Install pre-manufactured counterflashing with fasteners and neoprene washers or per manufacturer's recommendations.
6. Set equipment on neoprene pad and fasten as required by equipment manufacturer.

3.9 FIELD QUALITY CONTROL

A. The roof manufacturer shall employ and pay for a qualified inspection agent for daily inspection work for this project, **3 days per week minimum or daily as required for the warranty to be provided**. A weekly report shall be emailed weekly to the CM, Architect and Owner for their records. See Specification Section 01400, Quality Control for details.

B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.

1. Notify Architect and Owner 48 hours in advance of the date and time of inspection.

3.10 PROTECTING AND CLEANING

A. Protect modified bituminous membrane roofing from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Adjacent roof areas not-in-contract must be fully protected from construction activities and traffic using means and methods approved by manufacturer holding the existing warranty. Provide minimum 2" extruded polystyrene insulation and ½" plywood protection laid down over any existing roofs to remain that will be used for transport of materials or personnel access to construction areas. Limit storage of materials to in-contract roof areas. Engage warranty holder for a post-construction inspection any roofs that may have been affected by construction traffic.

C. Correct deficiencies in or remove modified bituminous roofing that does not comply with requirements, repair substrates, reinstall roofing, and repair base flashings to a condition free of damage and deterioration at the time of Substantial Completion and according to warranty requirements.

D. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.11 ROOFING INSTALLER'S WARRANTY

A. WHEREAS <NAME> of <ADDRESS>, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

1 Owner:
2 Address:
3 Building Name/Type:
4. Address:
5. Area of Work: As per the Construction Documents.
6 Acceptance Date:
7 Warranty Period:
8 Expiration Date:

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period.

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1 Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
   a. lightning;
   b. peak gust wind speed exceeding 90 mph;
   c. fire;
   d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;

e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
f. vapor condensation on bottom of roofing; and
g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized r unauthorized by Owner.

2 When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof has been paid by Owner or by another responsible party so designated.

3 The Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents, resulting from leaks or faults or defects of work.

4 During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void, unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.

5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.

6 The Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.

7 This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this <DAY> day of <MONTH>, <YEAR>.

1 Authorized Signature:
2 Name:
3 Title:

END OF SECTION 07552

SECTION 07620 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including the Conditions of the Contract and Division 01 Specification Sections apply to this section.

1.2 SUMMARY

A. Provide all labor, equipment, and materials to fabricate and install the following.

1. Manufactured drip edge and flashing.
2. Gutters and downspouts
3. Fascia and edge metal.
4. Counterflashings

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM)

1.	ASTM A653	Standard Specification for Steel Sheet, Zinc-Coated (galvanized) or Zinc-Iron Alloy-Coated (galvannealed) by the Hot-Dip Process.
2.	ASTM A792	Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy Coated by the Hot-Dip Process.
3.	ASTM B209	Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
4.	ASTM B221	Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
5.	ASTM D692	Standard Specification for Coarse Aggregate for Bituminous Paving Mixtures.

B. Warnock Hersey International, Inc., Middleton, WI (WH)

C. Factory Mutual Research Corporation (FMRC)

D. Underwriters Laboratories (UL)

E. Sheet Metal and Air Conditioning Contractors National Association (SMACNA)

1. Architectural Sheet Metal Manual

F. National Roofing Contractors Association (NRCA).

1. Roofing and Waterproofing Manual

G. Single Ply Roofing Institute (SPRI).

1. Wind Design Guide for Use with Low Slope Roofing

1.4 SUBMITTALS FOR REVIEW

A. Product Data:

1. Provide manufacturer's specification data sheets for each product.
2. Metal material characteristics and installation recommendations.
3. Submit color chart prior to material ordering and/or fabrication so that equivalent colors to those specified can be approved.

B. Samples: Submit two (2) samples, illustrating typical metal edge, coping, gutters, fascia extenders for material and finish.

C. Shop Drawings:

1. For manufactured and shop fabricated gravel stops, fascia, scuppers, and all other sheet metal fabrications.
2. Indicate material profile, jointing pattern, jointing details, fastening methods, flashing, termination's, and installation details.
3. Indicate type, gauge and finish of metal.

D. Specimen Warranty: Provide an unexecuted copy of the warranty specified for this Project, identifying the terms and conditions required of the Manufacturer and the Owner.

1.5 SUBMITTALS FOR INFORMATION

A. Design and Test Reports: Provide the following certified test reports from an independent testing laboratory:

1. Independent laboratory testing report for system design load and seam integrity.
2. Professional engineer's documentation that system incorporates sufficient allowance for stress and movement.
3. A letter from an officer of the manufacturing company certifying that the materials furnished for this project are the same as represented in tests and supporting data.
4. Manufacturer's verifications that the panels are factory roll-formed.
5. UL 1897: Test report must be submitted for windstorm rating no less than that specified in Design and Performance Criteria article. The proposed roof system must have approval over specified substrate with steel framing spaced no further apart than as specified.

B. Product Data:

1. Provide manufacturer's specification data sheets for each product.
2. Metal material characteristics and installation recommendations.
3. Submit color chart prior to material ordering and/or fabrication so that equivalent colors to those specified can be approved.

C. Samples: Submit two (2) samples, illustrating typical products to be used for the project (metal edge, coping, gutters, fascia extenders) for material and finish.

D. Shop Drawings

1. For manufactured and ANSI/SPRI ES-1 compliant shop fabricated gravel stops, fascia, scuppers, and all other sheet metal fabrications.
2. Indicate material profile, jointing details, fastening methods, flashing, terminations, and installation details.
3. Indicate type, gauge and finish of metal

E. Specimen Warranty: Provide an unexecuted copy of the warranty specified for this Project, identifying the terms and conditions required of the Manufacturer and the Owner. Pre-manufactured metal roof edge components are to be provided by the roof system manufacturer and covered under membrane manufacturer's warranty.

1.6 CONTRACT CLOSEOUT SUBMITTALS

A. General: Comply with Requirements of Section 01 78 00 – Closeout Submittals.

B. Special Project Warranty: Provide specified warranty for the Project, executed by the authorized agent of the Manufacturer.

C. Roofing Maintenance Instructions. Provide a manual of manufacturer's recommendations for maintenance of installed roofing systems.

D. Insurance Certification: Assist Owner in preparation and submittal of roof installation acceptance certification as may be necessary in connection with fire and extended coverage insurance on roofing and associated work.

1.7 QUALITY ASSURANCE

A. Engage an experienced roofing contractor specializing in sheet metal flashing work with a minimum of five (5) years' experience.

B. Maintain a full-time supervisor/foreman who is on the job-site at all times during installation. Foreman must have a minimum of five (5) years' experience with the installation of similar system to that specified.

C. Source Limitation: Obtain components from a single manufacturer. Secondary products which cannot be supplied by the specified manufacturer shall be approved in writing by the primary manufacturer prior to bidding.

D. Upon request fabricator/installer shall submit work experience and evidence of financial responsibility. The Owner's representative reserves the right to inspect fabrication facilities in determining qualifications.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original, unopened containers or packages with labels intact and legible.

B. Stack pre-formed and pre-finished material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

C. Prevent contact with materials which may cause discoloration or staining.

1.9 PROJECT CONDITIONS

A. Determine that work of other trades will not hamper or conflict with necessary fabrication and storage requirements for pre-formed metal edge system.

1.10 DESIGN AND PERFORMANCE CRITERIA

A. Thermal expansion and contraction:

1. Completed metal edge flashing system shall be capable of withstanding expansion and contraction of components caused by changes in temperature without buckling, producing excess stress on structure, anchors or fasteners, or reducing performance ability.

1.11 WARRANTIES

A. Owner shall receive one (1) warranty from manufacturer of roofing materials covering all of the following criteria. Multiple warranties are not acceptable.

1. Pre-finished metal material shall require a written 20-year non-prorated warranty covering fade, chalking and film integrity. The material shall not show a color change greater than 5 NBS color units per ASTM D-2244 or chalking excess of 8 units per ASTM D-659. If either occurs material shall be replaced per warranty, at no cost to the Owner.
2. Changes: Changes or alterations in the edge metal system without prior written consent from the manufacturer shall render the system unacceptable for warranty(ies).
3. Warranty shall commence on date of substantial completion or final payment, whichever is agreed by contract.
4. The Contractor shall provide the Owner with a notarized written warranty assuring that all sheet metal work including caulking and fasteners to be watertight and secure for a period of five years from the date of final acceptance of the building. Warranty shall include all materials and workmanship required to repair any leaks that develop, and make good any damage to other work or equipment caused by such leaks or the repairs thereof.
5. Installing roofing contractor shall be responsible for the installation of the edge metal system in general accordance with the membrane manufacturer's recommendations.
6. Installing contractor shall certify that the edge metal system has been installed per the manufacturer's printed details and specifications.
7. One manufacturer shall provide a single warranty for all accessory metal for flashings, metal edges and copings, along with the warranty for metal roof areas, membrane roof areas, and any transitions between two different material types.

PART 2 PRODUCTS

2.1 PRODUCTS, GENERAL

A. Refer to Division 01 Section "Common Product Requirements."

B. Basis of Design: Materials, manufacturer's product designations, and/or manufacturer's names specified herein shall be regarded as the minimum standard of quality required for work of this Section. Comply with all manufacturer and contractor/fabricator quality and performance criteria specified in Part 1.

C. Substitutions: Products proposed as equal to the products specified in this Section shall be submitted in accordance with Bidding Requirements and Division 01 provisions.

1. Proposals shall be accompanied by a copy of the manufacturer's standard specification section. That specification section shall be signed and sealed by a professional engineer licensed in the state in which the installation is to take place. Substitution requests containing specifications without licensed engineer certification shall be rejected for non-conformance.

2. Include a list of three (3) projects of similar type and extent, located within a one-hundred-mile radius from the location of the project. In addition, the three projects must be at least five (5) years old and be available for inspection by the Architect, Owner or Owner's Representative.

3. Equivalency of performance criteria, warranty terms, submittal procedures, and contractual terms will constitute the basis of acceptance.

4. The Owner's decision regarding substitutions will be considered final. Unauthorized substitutions will be rejected.

2.2 ACCEPTABLE MANUFACTURERS

A. The design is based upon sheet metal flashing and trim systems engineered and manufactured by

1. Roofing System Manufacturer

2.3 MATERIALS

A. General: Product designations for the materials used in this section shall be based on performance characteristics and shall form the basis of the contract documents.

B. Materials:

1. Minimum gauge of aluminum to be specified in accordance with Architectural Sheet Metal Manual, Sheet Metal and Air Conditioning Contractor's National Association, Inc. recommendations.

C. Premanufactured Drip Edge

1. Aluminum, ASTM B209, alloy 3105-H14, in thickness of 050" nom.

D. Perimeter Edge Metal: Manufactured metal edge system

1. Exposed base metal material:

a. Exposed base metal material for copings, fascia, and trim components: Aluminum, ASTM B209, alloy 3105-H14, in thickness of .050" nom.

2. Unexposed base metal material:

a. Flash-less Snap-On Fascia Extruded Base Anchor and Anchor Splice Plates: 6005A-T61 extruded aluminum

3. Components for Flashless metal edge system

a. Compression Seal for top of anchor: TPE thermoplastic elastomer.
b. Sealant for Flange: Single-component high performance 100% solids, interior and exterior polyether joint sealant

4. Minimum gauge of aluminum to be specified in accordance with Architectural Sheet Metal Manual, Sheet Metal and Air Conditioning Contractor's National Association, Inc. recommendations.

E. Gutters

1. Aluminum, ASTM B209, alloy 3105-H14, in thickness of 040" nom.

2. Continuous roll formed 7" gutter by Garrity Manufacturing or approved equal.

3. Gutter straps: .063 aluminum. Hangers as recommended by gutter manufacturer.

F. Downspouts

1. .125" extruded aluminum downspouts, 4"x4" as indicated on project drawings

G. Finishes:

1. Exposed surfaces for coated panels:

a. Steel Finishes: fluorocarbon finish. Epoxy primer baked both sides, .2-.25 mils thickness as approved by finish coat manufacturer. Weathering finish as referred by National Coil Coaters Association (NCCA).

Property	Test Method	Fluorocarbon*	
Pencil Hardness	ASTM D-3363 NCAA II-2	HB-H	
Bend	ASTM D-4145	O-T	NCAA II-19
Cross-Hatch Adhesion	ASTM D-3359	no loss of adhesion	
Gloss (60° angle)	ASTM D-523	25+/-5%	
Reverse Impact	ASTM D-2794	no cracking or loss of adhesion	

Nominal Thickness	ASTM D-1005
primer	0.2 mils
topcoat	0.8 mils
TOTAL	1.0 mils

*Subject to minimum quantity requirements

b. Color shall be as specified

2. Exposed and unexposed surfaces for mill finish flashing, fascia, and coping cap, shall be as shipped from the mill.

2.4 RELATED MATERIALS AND ACCESSORIES

A. Metal Primer: Zinc chromate type.

B. Plastic Cement: ASTM D 4586

C. Sealant: Specified in Section 07900 or on drawings.

D. Underlayment: 45 mil high performance underlayment as recommended by roof system manufacturer.

E. Fasteners:

1. Corrosion resistant screw fastener as recommended by metal manufacturer. Finish exposed fasteners same as flashing metal.
2. Fastening shall conform to Factory Mutual 1-90 requirements or as stated on section details, whichever is more stringent.

F. Downspout Anchorage Devices: See drawings for location of attachment (minimum of 2 per downspouts) and material type.

G. Scupper boxes are to be welded and post painted.

PART 3 - EXECUTION

3.1 EXECUTION, GENERAL

A. Refer to Division 07 Section Common Work Results for Thermal and Moisture Protection.

3.2 PROTECTION

A. Isolate metal products from dissimailar metals, masonry or concrete with bituminous paint, tape, or slip sheet. Use gasketed fasteners where required to prevent corrosive reactions.

3.3 GENERAL

A. Install facia extender securely anchored to the wood blocking with a continious cleat. Secure subsequent cant dam to wood nailers at the bottom edge with a continuous cleat.

B. Fastening of metal to walls and wood blocking shall comply with SMACNA Architectural Sheet Metal Manual, and manufacturer's recommendations whichever is the most stringent standard.

C. All accessories or other items essential to the completeness of sheet metal installation, whether specifically indicated or not, shall be provided and of the same material as item to which applied.

D. Allow sufficient clearences for expansion and contraction of linear metal components.

E. Secure metal using fasteners as required by the system. Exposed face fastening will be rejected.

3.4 INSPECTION

A. Verify that curbs are solidly set and nailing strips located.

B. Perform field measurements prior to fabrication.

C. Coordinate work with work of other trades.

D. Verify that substrate is dry, clean and free of foreign matter.

E. Commencement of installation shall be considered acceptance of existing conditions.

3.5 MANUFACTURED SHEET METAL SYSTEMS

A. Furnish and install manufactured fascia, fascia extender and coping cap systems in strict accordance with manufacturer's printed instructions.

B. Provide factory-fabricated accessories including, but not limited to, fascia extenders, miters, scuppers, joint covers, etc. Refer to Source limitation provision in Part 1.

3.6 SHOP-FABRICATED SHEET METAL (ACCESSORY TRIM)

A. Metal work shall be shop fabricated to configurations and forms in accordance with recognized sheet metal practices. Fabricate scuppers as shown of drawing

B. Hem exposed edges.

C. Angle bottom edges of exposed vertical surfaces to form drip.

D. Lap corners with adjoining pieces fastened and set in sealant.

E. Install sheet metal to comply with referenced SMACNA and NRCA standards

3.7 ROOF EDGE WITH GUTTER

A. Inspect the nailer to assure proper attachment and configuration. Increase slope at metal edge by additional degree of slope in first board.

B. Run base flashing ply over the edge and turned down face. Assure coverage of all wood nailers. Fasten plies with ring shank nails at 8 inches (203 mm) o.c.

C. Install gutter and strapping. Gutter straps shall be installed 12" on center.

D. Install downspouts and anchor to building 5' on center.

E. Install continuous cleat and fasten at 6 inches (152 mm) o.c.

F. Install new metal edge hooked to continuous cleat and set in bed of roof cement. Fasten flange to wood nailer every 3 inches (76 mm) o.c. staggered.

G. Prime metal edge at a rate of 100 square feet per gallon and allow to dry.

H. Strip in flange with base flashing ply covering entire flange with 6 inch lap onto the field of the roof. Assure ply laps do not coincide with metal laps.

I. Install a second ply of modified flashing over the base flashing ply, 9 inches (228 mm) on to the field of the roof.

3.8 FLASHING MEMBRANE INSTALLATION

A. Flash-less Snap-On Fascia Detail with Extruded Aluminum Base Anchor

1. Position base ply of the Modified Roofing membrane over the roof edge covering nailers completely, fastening eight (8) inches on center. Install membrane and cap sheet with proper material and procedure according to manufacturer's recommendations. Cap sheet shall stop at the edge of the roof and shall not turn over the edge of the nailer.
2. Prior to installing the base anchor, assure a level plane is present. If not, shim the roof edge surface as required.
3. Extruded base anchor: Apply two 1/4" beads of Green-Lock Sealant XL or equal on the bottom surface of the top flange of the extruded anchor.
4. Set the extruded anchor on the edge and face fasten through pre-punched slots every 18 inches o.c. for 5.75 inch face fascia, and 18 inches o.c. staggered for any fascia size greater than 5.75 inches. Begin fastening 6 inches from ends.
5. Install Green-Lock Sealant XL or approved equal at the ends of the base frame to prevent water from running between base anchor joints.
6. Install compression seals every 40 inches on center in the slots located at the top of the extruded anchor.
7. Install fascia cover setting the top flange over the top flange and compression seals of the base anchor. Assure compression seals are in place during this process. Beginning on one end and working towards the opposite end, press downward firmly (do not rotate) until "snap" occurs and cover is engaged along entire length of miter.
8. Install splice plate at each end of the base anchor and fascia cover prior to the installation of the next adjacent ten foot piece.

3.9 CLEANING

A. Clean installed work in accordance with the manufacturer's instructions.

B. Replace damaged work than cannot be restored by normal cleaning methods.

3.10 CONSTRUCTION WASTE MANAGEMENT

A. Remove and properly dispose of waste products generated. Comply with requirements of authorities having jurisdiction

3.11 FINAL INSPECTION

A. At completion of installation and associated work, meet with Contractor, Architect, installer, installer of associated work, Owner, roofing system manufacturer's representative, and other representatives directly concerned with performance of roofing system.

B. Inspect work and flashing of roof penetrations, walls, curbs and other equipment. List all items requiring correction or completion and furnish copy of list to each party in attendance.

C. Repair or replace deteriorated or defective work found at time above inspection as required to a produce an installation which is free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

D. Notify the Architect upon completion of corrections.

E. Following the final inspection, provide written notice of acceptance of the installation from the roofing system manufacturer.

F. Immediately correct roof leakage during construction. If the Contractor does not respond within twenty-four (24) hours, the Owner will exercise rights to correct the Work under the terms of the Conditions of the Contract.

3.12 DEMONSTRATION AND TRAINING

A. At a time and date agreed to by the Owner, instruct the Owner's facility manager, or other representative designated by the Owner, on the following procedures:

1. Troubleshooting procedures.
2. Notification procedures for reporting leaks or other apparent roofing problems.
3. Maintenance.
4. The Owner's obligations for maintaining the warranty in effect and force.
5. The Manufacturer's obligations for maintaining the warranty in effect and force.

END OF SECTION

SECTION 07920 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes joint sealants for the following applications, including those specified by reference to this Section:

1. Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
2. Interior joints in vertical surfaces and horizontal nontraffic surfaces.

1.2 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.3 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Preconstruction field test reports.

D. Compatibility and adhesion test reports.

E. Product test reports.

1.4 QUALITY ASSURANCE

A. Preconstruction Compatibility and Adhesion Testing: Submit samples of materials that will contact or affect joint sealants to joint-sealant manufacturers for testing according to manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

B. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to Project joint substrates according to the method in ASTM C 1193 that is appropriate for the types of Project joints.

C. Mockups: Build mockups incorporating sealant joints, as follows, to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution:

1. Joints in mockups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants, which are specified by reference to this Section.

2. All test samples shall be approved and accepted by the Owner, Architect, Construction Manager and Manufacturer's field inspection personnel. Coordinate work and testing schedule with Manufacturer's field inspection personnel.

1.5 WARRANTY

A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Installers five (5) year workmanship warranty from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Twenty (20) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles or approved equal.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

B. VOC Content of Interior Sealants: Provide interior sealants and sealant primers that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.3 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

C. Suitability for Immersion in Liquids. Where elastomeric sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247 and qualify for the length of exposure indicated by reference to ASTM C 920 for Class 1 or 2. Liquid used for testing sealants is deionized water, unless otherwise indicated.

D. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

E. Single-Component **Neutral-Curing** Silicone Sealant for all exterior and interior joints application except as listed for other applications:

1. Products:
   a. Dow Corning Corporation; 790.
   b. GE Silicones; SilPruf LM SCS2700.
   c. Tremco; Spectrem 1 (Basic).
   d. Or approved equal.

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 100/50.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
6. Stain-Test-Response Characteristics: Nonstaining to porous substrates per ASTM C 1248.
7. Paintable surface.

F. Single-Component Neutral-Curing Silicone Sealant for structural glazing and aluminum framing:

1. Products:
   a. Dow Corning Corporation; 795.
   b. GE Silicones; UltraGlaze SSG4000.
   c. Polymeric Systems Inc.; PSI-631.
   d. Schnee-Morehead, Inc.; SM5731 Poly-Glaze Plus.
   e. Tremco; SPECTREM 2
   f. Or approved equal.

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: G, A, and, as applicable to joint substrates indicated, O.
6. Paintable surface.

G. Single-Component Mildew-Resistant Neutral-Curing Silicone Sealant for all interior wet areas including all ceramic tiles:

1. Products:
   a. Pecora Corporation; 898.
   b. Tremco; Tremsil 600 White.
   c. Or approved equal.

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: G, A, and, as applicable to joint substrates indicated, O.

2.4 ACOUSTICAL JOINT SEALANTS – For all interior paintable gypsum / wood joints.

A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Products:
   a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
   b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.
   c. TREMSTOP ACRYLIC
   d. or approved equal.

B. Acoustical Sealant for Concealed Joints: Manufacturer's standard, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission for concealed gypsum / wood joints.

1. Products:
   a. Pecora Corporation; BA-98.
   b. Tremco; Tremco Acoustical Sealant.
   c. or approved equal.

2.5 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), O (open-cell material), B (bicellular material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F (minus 32 deg C). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.

D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.6 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants.

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant.

    a. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.

2. Remove laitance and form-release agents from concrete.

a. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.2 INSTALLATION

A. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

B. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
4. Complete sealant all the way of the full joint length, everywhere.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

G. Installation of Preformed Silicone-Sealant System: Comply with manufacturer's written instructions.

H. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

I. Conditions that should be avoided when working with Silicone Building Sealant:

1. **DO NOT** "wet tool" with solvents or soaps as this can inhibit the surface of this sealant, the rest of the sealant bulk may cure normally but the surface will remain tacky and gummy indefinitely.
2. **DO NOT** apply this sealant to a backer rod that is contaminated with solvent or primer.
3. **DO NOT** apply this sealant to a surface that has been cleaned with a solvent or primer.
4. **DO NOT** apply this sealant to EPOXY containing surfaces (unless they have been tested by The Americas Construction Test Lab) since they can inhibit the cure.

J. Do not use silicone sealant for:

1. Below-grade applications.
2. Surfaces to be immersed in water for prolonged time.
3. Brass and copper surfaces.
4. Materials bleeding oils, plasticizers, and solvents.
5. Structural glazing and adhesive.
6. Surfaces to be painted.
7. Surfaces in direct contact with food.
8. Medical and pharmaceutical applications.

K. Do not apply in totally confined spaces without ventilation for curing.

END OF SECTION 07920

SECTION 08110- STEEL DOORS AND FRAMES

1.1 GENERAL

A. Submit Product Data for each type of door and frame specified.

B. Quality Assurance: Comply with ANSI/SDI 100.

1.2 PRODUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

1. Amweld Building Products, Inc.
2. Benchmark Commercial Doors.
3. Ceco Door Products.
4. Copco Door Co.
5. Curries Co.
6. Deansteel Manufacturing Co.
7. Fenestra Corp.
8. Kewanee Corp.
9. Mesker Door, Inc.
10. Pioneer Industries.
11. Republic Builders Products.
12. Steelcraft.
13. Or approved equal.

B. Cold-Rolled Steel Sheets: ASTM A 366 (ASTM A 366M), commercial quality, or ASTM A 620 (ASTM A 620M), drawing quality.

C. Galvanized Steel Sheets: ASTM A 526 (ASTM A 526M), commercial quality, or ASTM A 642 (ASTM A 642M), drawing quality, with A 60 or G 60 (Z 180 or ZF 180) coating designation, mill phosphatized.

D. Steel Doors: Provide 1-3/4-inch- (44-mm-) thick doors of materials and ANSI/SDI 100 grades and models specified below, or as indicated on Drawings or schedules:

1. Exterior Doors: Grade III, extra heavy-duty, Model 2, seamless design, minimum 16 gage thick galvanized steel sheet faces with insulation core to have a minimum R Value of 11.25.

E. Frames: Provide frames for doors, sidelights, borrowed lights, and other openings that comply with ANSI/SDI 100; fabricate to be rigid, neat in appearance, and free from defects, warp, or buckle.

1. For interior frames provide units with mitered or coped and continuously welded corners, formed from 16 gage thick cold-rolled steel.
2. For exterior frames provide units with mitered or coped and continuously welded corners, formed from 16 gage thick galvanized steel sheet.
3. Door Silencers: 3 on strike jambs of single-door frames and 2 on heads of double-door frames.
4. Plaster Guards: Provide where mortar might obstruct hardware operation and to

close off interior of openings.

5. For new frame install in existing opening. Knock down frame is allowed to secure to existing opening.
6. Grout: As specified in Division 4 Section "Unit Masonry."

F. Tolerances: Comply with SDI 117.

G. Fabricate concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold- or hot-rolled steel sheet.

H. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware according to SDI 107 and the hardware specification.

I. Finishes, General: Comply with NAAMM's "Metal Finishes Manual" for recommendations relative to applying and designating finishes.

1. Apply primers to doors and frames after fabrication.

J. Galvanized Steel Sheet Finishes: Comply with SDI 112 and the following:

1. Surface Preparation: Clean surfaces with nonpetroleum solvent so that surfaces are free of oil or other contaminants. After cleaning, apply a conversion coating of the type suited to the organic coating applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified to comply with ASTM A 780.
2. Galvanizing Repair Paint: SSPC-Paint 20, high-zinc-dust-content paint with dry film containing not less than 94 percent zinc dust by weight.
3. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply air-dried primer specified below immediately after cleaning and pretreatment.
   a. Shop Primer: Zinc-dust, zinc-oxide primer paint complying with performance requirements of FS TT-P-641, Type II.
4. Field Painted Finish: Immediately after cleaning and pretreating, apply 2-coat finish consisting of prime coat and finish coat. See Section 09900, "Painting."
   a. Color and Gloss: To match existing as selected by Owner.

K. Steel Sheet Finishes: Comply with SSPC-PA 1, "Paint Application Specification No. 1."

1. Surface Preparation: Solvent-clean surfaces according to SSPC-SP 1. Remove mill scale and rust to comply with SSPC-SP 5 (White Metal Blast Cleaning) or SSPC-SP 8 (Pickling).
2. Pretreatment: Immediately after surface preparation, apply a conversion coating suited to organic coating applied over it.
3. Factory Priming for Field-Painted Finish: Apply shop primer that complies with ANSI A224.1 acceptance criteria, is compatible with finish paint systems indicated, and has capability to provide a sound foundation for field-applied topcoats. Apply primer immediately after surface preparation and pretreatment.
   a. Color and Gloss: To match existing as selected by Owner

1.3 EXECUTION

A. General: Install steel doors, frames, and accessories according to Shop Drawings, manufacturer's data, and as specified.

B. Placing Frames: Comply with provisions of SDI 105, unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set.

1. Except for frames located in existing concrete, masonry, or gypsum board assembly construction, place frames before constructing enclosing walls and ceilings.
2. Install at least 3 anchors per jamb adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb.
3. In-place gypsum board partitions, install knock-down, slip-on, drywall frames.
4. Install fire-rated frames according to NFPA 80.
5. Coordinate installation of all required wiring/conduit prior to frame installation.

C. Door Installation: Fit exiting hollow-metal doors accurately in new hollow-metal frames, within clearances specified in ANSI/SDI 100, including new door in existing frame.

1. Fire-Rated Doors: Install with clearances specified in NFPA 80.
2. Smoke-Control Doors: Comply with NFPA 105.

D. Prime Coat Touchup: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.

E. Protection Removal: Immediately before final inspection, remove protective wrappings from doors and frames.

END OF SECTION 08110

SECTION 08211 - FLUSH WOOD DOORS

1.1 GENERAL

A. Submittals: In addition to product data, submit the following:

1. Shop drawings indicating location and size of each door, elevation of each kind of door, details of construction, location and extent of hardware blocking, fire ratings, requirements for veneer matching and factory finishing and other pertinent data. For factory-machined doors, indicate dimensions and locations of cutouts for locksets and other cutouts adjacent to light and louver openings.
2. Samples of actual materials in small sections for each face material and finish.

B. Quality Standard: Comply with the following standard:

1. NWWDA Quality Standard: I.S.1-A, "Architectural Wood Flush Doors," of the National Wood Window and Door Association.
2. AWI Quality Standard: "Architectural Woodwork Quality Standards" of the Architectural Woodwork Institute.

C. Fire-Rated Wood Doors: Provide wood doors labeled and listed by UL, Warnock Hersey, or another testing and inspection agency acceptable to authorities having jurisdiction. Provide certification for fire rating required acceptable to authorized agencies having jurisdiction for oversize fire rated doors over 4'-0" wide

D. Warranty

1. Provide manufacturer's warranty to the following term:

a. Interior Solid Core Doors: "Full Life of Original Installation" including rehang and refinish if door(s) do not comply with Warranty tolerance standards.

1.2 PRODUCTS

A. Manufacturers: Subject to compliance with requirements, provide doors by one of the following or approved equal:

1. Marshfield Door Systems, Inc., quality as defined in this section.
2. Algoma Wood Doors Inc., quality as defined in this section.
3. Eggers Wood Doors Inc., quality as defined in this section.
4. Mohawk Wood Doors Inc., quality as defined in this section.
5. V-T Industries Inc., quality as defined in this section.
6. Buell Door Company, quality as defined in this section.
7. Or approved equal.

B. Interior Solid Core Doors for Transparent Finish: As follows:
NOTE: ALL WOOD VENEER MUST APPEAR UNIFORM AND LIGHT IN APPEARANCE

1. Faces: Select White Birch, plain sliced.
2. Grade: "A" Select White ONLY

3. Construction: 5 plies.
4. Core: Structural composite lumber (engineered composite core)
5. Bonding: Stiles and rails bonded to core, then entire unit abrasive planed before veneering.

C. Interior Fire-Rated Solid Core Doors: As follows:

1. Faces and Grade: Provide faces and grade to match non-fire-rated doors in same area of building, unless otherwise indicated.
2. Edge Construction: Provide manufacturer's standard laminated-edge construction for improved screw-holding capability and split resistance.
3. Pairs: Furnish formed-steel edges and astragals for pairs of fire-rated doors, unless otherwise indicated.
4. Pairs: Provide fire-rated pairs with fire-retardant stiles that are labeled and listed for kinds of applications indicated without formed-steel edges and astragals.

D. Pairs and Sets: Provide pair matching and set matching.

E. Fabricate flush wood doors to comply with following requirements:

1. In sizes indicated for job-site fitting.
2. Factory fit doors to comply with clearance requirements of referenced quality standard. Comply with requirements of NFPA 80 for fire-resistance-rated doors.
3. Factory machine doors for hardware that is not surface applied.

   a. Metal Removable Mullions: Pre-machine locks and formed-steel edges for hardware for pairs of doors requiring removable mullions. See the Hardware Schedule.

4. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.

   a. Light Openings: Trim openings with moldings of material and profile indicated. * To be selected from manufacturer's standard profiles and colors unless noted otherwise. At existing buildings, metal trim shall be required to match adjacent existing to remain.
   b. Louvers: Factory install louvers in prepared openings.

5. Provide metal flashing at top of out swinging units.

F. Finish wood doors at factory as factory finished.

1. Transparent Finish: Comply with requirements indicated for grade, finish system, staining effect, and sheen.

   a. Grade: Custom.
   b. Finish: Manufacturer's standard finish with performance requirements comparable to either AWI System TR-2 catalyzed lacquer or AWI System TR-4 conversion varnish.
   c. Staining: Match Architect's sample or existing buildings' wood doors.

d. Effect: Filled finish.
e. Sheen: Semigloss.

G. Provide soundproof seal as noted in the Hardware Schedule. Adjust Hardware and frame to align properly to have the best acoustical effect.

1.3 EXECUTION

A. Examination

1. Verify substrate-openings conditions.
2. Verify that opening sizes and tolerances are acceptable and ready to receive this work.
3. Do not install doors in frame openings that are not plumb or are out of tolerance for size or alignment.

B. Installation

1. Install fire-rated and non-rated doors in accordance with NFPA 80, manufacturers' instructions and fire rated labeling requirements.
2. Trim non-rated door width by cutting equally on both jamb edges.
3. Trim door height by cutting bottom edges to a maximum 3/4 inch (19mm).
4. Trim fire door height at bottom edge only, in accordance with fire rating requirements.
5. Pilot drill screw and bolt holes using templates provided by hardware manufacturer. (Use threaded through bolts for half surface hinges.)
6. Coordinate installation of doors with installation of frames and hardware.
7. Coordinate installation of glass and glazing.
8. Install door louvers and light kits plumb and level.
9. Reseal or refinish any doors that required site alteration.

C. Warranty Tolerances

1. Conform to WDMA standards and testing methods for warp, cup, bow and telegraphing.

D. Adjusting

1. Adjust work under provisions Division 1.
2. Adjust doors for smooth and balanced door movement.

E. Door and Frame Components Schedules

1. Refer to door and frame schedule.

END OF SECTION 08211

SECTION 08361 – SECTIONAL OVERHEAD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes electrically operated sectional insulated overhead doors.

1.2 SUBMITTALS

A. Product Data: For each type and size of sectional overhead door and accessory.

B. Shop Drawings: For special components and installations not detailed in manufacturer's product data.

C. Samples: For each exposed finish.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following or approved equal:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

1. BASIS OF DESIGN: Glazed Sectional Insulated Overhead Door: Thermacore Door Systems – Model 592 by Overhead Door Corporation or approved equal.

a. Arm-R-Lite.
b. Fimbel Door Corporation.
c. Haas Door; a Nofziger Company.
d. Overhead Door Corp.
e. Raynor.

2.2 DOOR SECTIONS

A. Glazed Sectional Overhead Doors: 521 Series Aluminum Doors by Overhead Door Corporation or approved equal.

1. Door Assembly:

a. Panel Thickness: 2 inches

b. Exterior Surface: Ribbed, textured

c. Exterior Steel: .015 inch, hot dipped galvanized

d. End Stiles:16 gauge with thermal break

e. Spring Counterbalance: Sized to weight of the door, with a helically wound, oil tempered torsion spring mounted on steel shaft, drum of diecast aluminum with high strength galvanized aircraft cable. Sized with a minimum 7 to 1 safety factor.

1) Standard cycle spring: 10,000 cycles

f. Insulation: CFC-free and HCFC-free polyurethane, fully encapsulated.

g. Aluminum Panels: 0.050 inch thick, aluminum.

h. Thermal Values: R-Value of 17.50; U-Value of 0.057.

i. Air infiltration: 0.08 cfm at 15 mph; 0.08 cfm at 25 mph.

j. Partial Glazing of Steel Panels:

1) Double Thermal Acrylic (25" w by 12" h)

2. Finish and Color:

a. Interior Color: Color as selected by Owner from manufacturer's full range of available colors. Include custom color match to match Owner's sample.

b. Exterior Color: Color as selected by Owner from manufacturer's full range of available colors Include custom color match Owner's sample.

3. Windload Design: Provide to meet the Design/Performance requirements specified.

4. Hardware: Galvanized steel hinges and fixtures. Ball bearing rollers with hardened steel races.

5. Lock: Interior mounted slide lock with interlock switch for automatic operator.

6. Weatherstripping:

a. Flexible bulb-type strip at bottom section.

b. Flexible Jamb seals.

c. Flexible Header seal.

7. Track: Provide track size and type installed as recommended by manufacturer to suit loading required and clearances available.

8. Electric Motor Operation: Provide UL listed electric operator, size and type as recommended by manufacturer to move door in either direction at not less than 2/3 foot nor more than 1 foot per second. Operator shall meet UL325/2010 requirements for continuous monitoring of safety devices.

   a. Entrapment Protection: Required for momentary contact, includes radio control operation.

      1) Pneumatic sensing edge up to 18 feet (5.5 m) wide. Constant contact only complying with UL 325/2010.

      2) Electric sensing edge monitored to meet UL 325/2010.

      3) Photoelectric sensors monitored to meet UL 325/2010.

   b. Operator Controls:

      1) Push-button and key operated control stations with open, close, and stop buttons.

      2) Flush mounting.

      3) interior location.

2.3 TRACKS, SUPPORTS, AND ACCESSORIES

A. Tracks: Manufacturer's low profile, galvanized steel track system, sized for door size and weight, designed for lift type indicated and clearances shown, including brackets, bracing, and reinforcement for rigid support of ball-bearing roller guides for required door type and size. Weld or bolt to track supports.

   1. Provide tracks configured for the lift type required for each opening:

      a. LIFT CLEARANCE: Contractor shall field verify steel roof framing and MEP equipment obstructions and propose maximum lift clearance via shop drawing submittals.

   2. Track Reinforcement and Supports: Galvanized steel supporting members to provide strength and rigidity during opening and closing of doors. Provide framing and supports as required and so not to interfere with adjacent MEP equipment.

PART 3 - EXECUTION

1.2 EXAMINATION

A. Do not begin installation until openings have been properly prepared.

B. Verify wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.

C. Verify electric power is available and of correct characteristics.

D. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

1.3 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

1.4 INSTALLATION

A. Install overhead doors and track in accordance with approved shop drawings and the manufacturer's printed instructions.

B. Coordinate installation with adjacent work to ensure proper clearances and allow for maintenance.

C. Anchor assembly to wall construction and building framing without distortion or stress.

D. Securely brace door tracks suspended from structure. Secure tracks to structural members only.

E. Fit and align door assembly including hardware.

F. Coordinate installation of electrical service. Complete power and control wiring from disconnect to unit components.

1.5 CLEANING AND ADJUSTING

A. Adjust door assembly to smooth operation and in full contact with weatherstripping.

B. Clean doors, frames and glass.

C. Remove temporary labels and visible markings.

1.6 PROTECTION

A. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

B. Protect installed products until completion of project.

C. Touch-up, damaged coatings and finishes and repair minor damage before Substantial Completion.

END OF SECTION 08361

SECTION 08710 – DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Mechanical and electrified door hardware
2. Electronic access control system components

B. Section excludes:

1. Windows
2. Cabinets (casework), including locks in cabinets
3. Signage
4. Toilet accessories
5. Overhead doors

1.02 REFERENCES

A. UL LLC

1. UL 10B - Fire Test of Door Assemblies
2. UL 10C - Positive Pressure Test of Fire Door Assemblies
3. UL 1784 - Air Leakage Tests of Door Assemblies
4. UL 305 - Panic Hardware

B. DHI - Door and Hardware Institute

1. Sequence and Format for the Hardware Schedule
2. Recommended Locations for Builders Hardware
3. Keying Systems and Nomenclature
4. Installation Guide for Doors and Hardware

C. NFPA – National Fire Protection Association

1. NFPA 70 – National Electric Code
2. NFPA 80 – 2016 Edition – Standard for Fire Doors and Other Opening Protectives
3. NFPA 101 – Life Safety Code
4. NFPA 105 – Smoke and Draft Control Door Assemblies
5. NFPA 252 – Fire Tests of Door Assemblies

D. ANSI - American National Standards Institute

1. ANSI A117.1 – 2017 Edition – Accessible and Usable Buildings and Facilities
2. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties
3. ANSI/BHMA A156.28 - Recommended Practices for Keying Systems
4. ANSI/WDMA I.S. 1A - Interior Architectural Wood Flush Doors
5. ANSI/SDI A250.8 - Standard Steel Doors and Frames

1.03 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 Submittal Procedures.
2. Prior to forwarding submittal:
   a. Review drawings and Sections from related trades to verify compatibility with specified hardware.
   b. Highlight, encircle, or otherwise specifically identify on submittals: deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.

B. Action Submittals:

1. Product Data: Submit technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:
   a. Wiring Diagrams: For power, signal, and control wiring and including:
      1) Details of interface of electrified door hardware and building safety and security systems.
      2) Schematic diagram of systems that interface with electrified door hardware.
      3) Point-to-point wiring.
      4) Risers.

3. Samples for Verification: If requested by Architect, submit production sample of requested door hardware unit in finish indicated and tagged with full description for coordination with schedule.
   a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.

4. Door Hardware Schedule:
   a. Submit concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work critical in Project construction schedule.
   b. Submit under direct supervision of a Door Hardware Institute (DHI) certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule published by DHI.
   c. Indicate complete designations of each item required for each opening, include:
      1) Door Index: door number, heading number, and Architect's hardware set number.
      2) Quantity, type, style, function, size, and finish of each hardware item.
      3) Name and manufacturer of each item.
      4) Fastenings and other pertinent information.
      5) Location of each hardware set cross-referenced to indications on Drawings.
      6) Explanation of all abbreviations, symbols, and codes contained in schedule.
      7) Mounting locations for hardware.

8) Door and frame sizes and materials.
9) Degree of door swing and handing.
10) Operational Description of openings with electrified hardware covering egress, ingress (access), and fire/smoke alarm connections.

5. Key Schedule:
   a. After Keying Conference, provide keying schedule that includes levels of keying, explanations of key system's function, key symbols used, and door numbers controlled.
   b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
   c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
   d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
   e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion. Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
   f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.

C. Informational Submittals:

1. Provide Qualification Data for Supplier, Installer and Architectural Hardware Consultant.
2. Provide Product Data:
   a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
   b. Include warranties for specified door hardware.

D. Closeout Submittals:

1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:
   a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
   b. Catalog pages for each product.
   c. Final approved hardware schedule edited to reflect conditions as installed.
   d. Final keying schedule
   e. Copy of warranties including appropriate reference numbers for manufacturers to identify project.
   f. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.

E. Inspection and Testing:

1. Submit written reports to the Owner and Authority Having Jurisdiction (AHJ) of the results of functional testing and inspection for:
   a. Fire door assemblies, in compliance with NFPA 80.
   b. Required egress door assemblies, in compliance with NFPA 101.

1.04 QUALITY ASSURANCE

A. Qualifications and Responsibilities:

1. Supplier: Recognized architectural hardware supplier with a minimum of 5 years documented experience supplying both mechanical and electromechanical door hardware similar in quantity, type, and quality to that indicated for this Project. Supplier to be recognized as a factory direct distributor by the manufacturer of the primary materials with a warehousing facility in the Project's vicinity. Supplier to have on staff, a certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
2. Installer: Qualified tradesperson skilled in the application of commercial grade hardware with experience installing door hardware similar in quantity, type, and quality as indicated for this Project.
3. Architectural Hardware Consultant: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:
   a. For door hardware: DHI certified AHC or DHC.
   b. Can provide installation and technical data to Architect and other related subcontractors.
   c. Can inspect and verify components are in working order upon completion of installation.
   d. Capable of producing wiring diagram and coordinating installation of electrified hardware with Architect and electrical engineers.
4. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

B. Certifications:

1. Fire-Rated Door Openings:
   a. Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction.
   b. Provide only items of door hardware that are listed products tested by UL LLC, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.
2. Smoke and Draft Control Door Assemblies:
   a. Provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105
   b. Comply with the maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.
3. Electrified Door Hardware
   a. Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.

4. Accessibility Requirements:
   a. Comply with governing accessibility regulations cited in "REFERENCES" article 08710, 1.02.D3 herein for door hardware on doors in an accessible route. This project must comply with all Federal Americans with Disability Act regulations and all Local Accessibility Regulations.

C. Pre-Installation Meetings

1. Keying Conference
   a. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
      1) Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
      2) Preliminary key system schematic diagram.
      3) Requirements for key control system.
      4) Requirements for access control.
      5) Address for delivery of keys.

2. Pre-installation Conference
   a. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   b. Inspect and discuss preparatory work performed by other trades.
   c. Inspect and discuss electrical roughing-in for electrified door hardware.
   d. Review sequence of operation for each type of electrified door hardware.
   e. Review required testing, inspecting, and certifying procedures.
   f. Review questions or concerns related to proper installation and adjustment of door hardware.

3. Electrified Hardware Coordination Conference:
   a. Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site. Promptly replace products damaged during shipping.

B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package. Deliver each article of hardware in manufacturer's original packaging.

C. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.

D. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

E. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

F. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.06 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

1.07 WARRANTY

A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within published warranty period.

1. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.
2. Warranty Period: Beginning from date of Substantial Completion, for durations indicated in manufacturer's published listings.
    a. Mechanical Warranty
        1) Locks
            a) Schlage L Series: 3 years
        2) Exit Devices
            a) Von Duprin: 3 years
        3) Closers
            a) LCN 4000 Series: 30 years
            b) LCN 1450 Series: 25 years

1.08 MAINTENANCE

A. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

B. Turn over unused materials to Owner for maintenance purposes.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. The Owner requires use of certain products for their unique characteristics and project suitability to ensure continuity of existing and future performance and maintenance standards. Approved equal substitutions will be considered in accordance with Specification Section 01300-Submittals.

B. Approval of alternate manufacturers and/or products other than those listed as "Scheduled Manufacturer" or "Acceptable Manufacturers" in the individual article for the product category are only to be considered by official substitution request in accordance with section 01300-Submittals.

C. Approval of products from manufacturers indicated in "Acceptable Manufacturers" is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.

D. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.02 MATERIALS

A. Fabrication

1. Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. provide screws according to manufacturer's recognized installation standards for application intended.
2. Finish exposed screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
3. Provide concealed fasteners wherever possible for hardware units exposed when door is closed. Coordinate with "Metal Doors and Frames", "Flush Wood Doors", "Stile and Rail Wood Doors" to ensure proper reinforcements. Advise the Architect where visible fasteners, such as thru bolts, are required.

B. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.

1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

C. Cable and Connectors:

1. Where scheduled in the hardware sets, provide each item of electrified hardware and wire harnesses with number and gage of wires enough to accommodate electric function of specified hardware.
2. Provide Molex connectors that plug directly into connectors from harnesses, electric locking and power transfer devices.

3. Provide through-door wire harness for each electrified locking device installed in a door and wire harness for each electrified hinge, electrified continuous hinge, electrified pivot, and electric power transfer for connection to power supplies.

2.03 HINGES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
   a. Ives 3CB series or approved equal

2. Acceptable Manufacturers and Products:
   a. Hager AB700/800 series
   b. Best CB1900 series
   c. Or approved equal

B. Requirements:

1. Provide hinges conforming to ANSI/BHMA A156.1.
2. Provide 3 knuckle, concealed bearing hinges.
3. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
   a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
   b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high

4. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:
   a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
   b. Interior: Heavy weight, steel, 5 inches (127 mm) high

5. 2 inches or thicker doors:
   a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
   b. Interior: Heavy weight, steel, 5 inches (127 mm) high

6. Adjust hinge width for door, frame, and wall conditions to allow proper degree of opening.
7. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
8. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
   a. Steel Hinges: Steel pins
   b. Non-Ferrous Hinges: Stainless steel pins
   c. Out-Swinging Exterior Doors: Non-removable pins
   d. Out-Swinging Interior Lockable Doors: Non-removable pins
   e. Interior Non-lockable Doors: Non-rising pins

9. Width of hinges: 4-1/2 inches (114 mm) at 1-3/4 inch (44 mm) thick doors, and 5 inches (127 mm) at 2 inches (51 mm) or thicker doors. Adjust hinge width as required for door, frame, and wall conditions to allow proper degree of opening.
10. Provide hinges with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to electrified locking component. Provide mortar guard for each electrified hinge specified.

2.04 CONTINUOUS HINGES

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Ives or approved equal

2. Acceptable Manufacturers:
   a. Select
   b. ABH
   c. Hager
   d. Or approved equal

B. Requirements:

1. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.26, Grade 1.
2. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum.
3. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
4. Provide hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
5. On fire-rated doors, provide aluminum geared continuous hinges classified for use on rated doors by testing agency acceptable to authority having jurisdiction.
6. Provide aluminum geared continuous hinges with electrified option scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
7. Provide hinges 1 inch (25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

2.05 MORTISE LOCKS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
   a. Schlage L9000 series or approved equal

2. Acceptable Manufacturers and Products:
   a. Accurate 9000/9100 series
   b. Best 45H series
   c. Or approved equal

B. Requirements:

1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1, and UL Listed for 3-hour fire doors.
2. Indicators: Where specified, provide indicator window measuring a minimum 2-inch x 1/2 inch with 180-degree visibility. Provide messages color-coded with full text and/or symbols, as scheduled, for easy visibility.

3. Provide locks manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance.
4. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to "KEYING" article, herein.
5. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1-inch (25 mm) throw, constructed of stainless steel.
6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim. Provide electrified options as scheduled in the hardware sets. Where scheduled, provide switches and sensors integrated into the locks and latches.
7. Provide motor based electrified locksets that comply with the following requirements:
   a. Universal input voltage – single chassis accepts 12 or 24VDC to allow for changes in the field without changing lock chassis.
   b. Fail Safe/Fail Secure – changing mode between electrically locked (fail safe) and electrically unlocked (fail secure) is field selectable without opening the lock case.
   c. Low maximum current draw – maximum 0.4 amps to allow for multiple locks on a single power supply.
   d. Low holding current – maximum 0.01 amps to produce minimal heat, eliminate "hot levers" in electrically locked applications, and to provide reliable operation in wood doors that provide minimal ventilation and air flow.
   e. Connections – provide quick-connect Molex system standard.
8. (KEY OVERRIDE OPTION WHEN XL13-439 IS SPECIFIED IN HARDWARE SETS) Provide locks with a key override feature built into the chassis that allows the outside key to retract the deadbolt and/or latchbolt, overriding the inside thumbturn when it is being held in the locked position.
9. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.
   a. Vandlgard: Provide levers with vandal resistant technology for use at heavy traffic or abusive applications.
   b. Lever Design: <INSERT LEVER DESIGN>.

2.06 EXIT DEVICES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
   a. Von Duprin 98/35A series or approved equal.

2. Acceptable Manufacturers and Products:
   a. Detex Advantex series
   b. Precision APEX 2000 series
   c. Falcon 24/25 series
   d. Or approved equal.

B. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
2. Cylinders: Refer to "KEYING" article, herein.
3. Provide smooth touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
4. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
5. Provide exit devices with dead latching feature for security and for future addition of alarm kits and/or other electrified requirements.
6. Provide exit devices with weather resistant components that can withstand harsh conditions of various climates and corrosive cleaners used in outdoor pool environments.
7. Provide flush end caps for exit devices.
8. Provide exit devices with manufacturer's approved strikes.
9. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
10. Mount mechanism case flush on face of doors or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
11. Provide cylinder or hex-key dogging as specified at non fire-rated openings.
12. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
13. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
14. Provide electrified options as scheduled.
15. Top latch mounting: double- or single-tab mount for steel doors, face mount for aluminum doors eliminating requirement of tabs, and double tab mount for wood doors.
16. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.

2.07 CYLINDERS

A. Manufacturers:

1. Scheduled Manufacturer and Product:
   a. BEST or approved equal

2. Acceptable Manufacturers and Products:
   a. Approved equal

B. Requirements:

1. Provide cylinders/cores to match Owner's existing key system, compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article, herein.

2.08 KEYING

A. Scheduled System:

1. Existing factory registered system:
   a. Provide cylinders/cores keyed into Owner's existing factory registered keying system. Comply with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

B. Requirements:

1. Construction Keying:
   a. Replaceable Construction Cores.
      1) Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
         a) 3 construction control keys
         b) 12 construction change (day) keys.
      2) Owner or Owner's Representative will replace temporary construction cores with permanent cores.

2. Permanent Keying:
   a. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.
      1) Master Keying system as directed by the Owner.
   b. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements will be cause for replacement of cylinders/cores involved at no additional cost to Owner.
   c. Provide keys with the following features:
      1) Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
      2) Patent Protection: Keys and blanks protected by one or more utility patent(s).
      3) Geographically Exclusive: Where High Security or Security cylinders/cores are indicated, provide nationwide, geographically exclusive key system complying with the following restrictions.
   d. Identification:
      1) Mark permanent cylinders/cores and keys with applicable blind code for identification. Do not provide blind code marks with actual key cuts.
      2) Identification stamping provisions must be approved by the Architect and Owner.
      3) Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.
      4) Failure to comply with stamping requirements will be cause for replacement of keys involved at no additional cost to Owner.
      5) Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.
   e. Quantity: Furnish in the following quantities.
      1) Permanent Control Keys: 3.
      2) Master Keys: 6.
      3) Change (Day) Keys: 3 per cylinder/core that is keyed differently
      4) Key Blanks: Quantity as determined in the keying meeting.

2.09 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
   a. LCN 4010/4110/4020 series or approved equal.

2. Acceptable Manufacturers and Products:
   a. Corbin-Russwin DC8000 series or approved equal.

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. Certify surface mounted mechanical closers to meet fifteen million (15,000,000) full load cycles. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2-inch (38 mm) diameter with 11/16-inch (17 mm) diameter double heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers. When closers are parallel arm mounted, provide closers which mount within 6-inch (152 mm) top rail without use of mounting plate so that closer is not visible through vision panel from pull side.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI/BHMA Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.10 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
   a. LCN 1450 series or approved equal.

2. Acceptable Manufacturers and Products:
   a. Falcon SC80A series
   b. Norton 8000 series
   c. Or approved equal

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory.
2. Provide door closers with fully hydraulic, full rack and pinion action with cast aluminum cylinder.
3. Closer Body: 1-3/8-inch (35 mm) diameter with 5/8-inch (16 mm) diameter pinion journal diameter heat-treated pinion journal and full complement bearings.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Pressure Relief Valve (PRV) Technology: Not permitted.
7. Provide stick on and special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.11 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Ives or approved equal.

2. Acceptable Manufacturers:
   a. Burns
   b. Trimco
   c. Or approved equal.

B. Requirements:

1. Provide protection plates with a minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes plates 2 inches (51 mm) less width of door on single doors, pairs of doors with a mullion, and doors with edge guards. Size plates 1 inch (25 mm) less width of door on pairs without a mullion or edge guards.
3. At fire rated doors, provide protection plates over 16 inches high with UL label.

2.12 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Ives or approved equal.

2. Acceptable Manufacturers:
   a. Burns
   b. Trimco
   c. Or approved equal

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide concave type where lockset has a push button of thumbturn.
2. Where a wall stop cannot be used, provide universal floor stops.
3. Where wall or floor stop cannot be used, provide overhead stop.
4. Provide roller bumper where doors open into each other, and overhead stop cannot be used.

2.13 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Zero International or approved equal.

2. Acceptable Manufacturers:
   a. National Guard
   b. Reese
   c. DHSI
   d. Legacy
   e. Or approved equal

B. Requirements:

1. Provide thresholds, weather-stripping, and gasketing systems as specified and per architectural details. Match finish of other items.
2. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.
4. Size thresholds 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width unless otherwise specified in the hardware sets or detailed in the drawings.

2.14 FINISHES

A. FINISH: BHMA 626/652 (US26D); EXCEPT:

1. Hinges at Exterior Doors: BHMA 630 (US32D)
2. Aluminum Geared Continuous Hinges: BHMA 628 (US28)
3. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
4. Protection Plates: BHMA 630 (US32D)
5. Overhead Stops and Holders: BHMA 630 (US32D)
6. Door Closers: Powder Coat to Match
7. Wall Stops: BHMA 630 (US32D)
8. Latch Protectors: BHMA 630 (US32D)
9. Weatherstripping: Clear Anodized Aluminum

10. Thresholds: Mill Finish Aluminum

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance. Verify doors, frames, and walls have been properly reinforced for hardware installation.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Submit a list of deficiencies in writing and proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.
3. Interior Architectural Wood Flush Doors: ANSI/WDMA I.S. 1A
4. Installation Guide for Doors and Hardware: DHI TDH-007-20

B. Install door hardware in accordance with NFPA 80, NFPA 101 and provide post-install inspection, testing as specified in section 1.03.E unless otherwise required to comply with governing regulations.

C. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.

D. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.

E. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

F. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

G. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.

H. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated.

I. Lock Cylinders:

1. Install construction cores to secure building and areas during construction period.
2. Replace construction cores with permanent cores as indicated in keying section.
3. Furnish permanent cores to Owner for installation.

J. Wiring: Coordinate with Division 26, ELECTRICAL and Division 28 ELECTRONIC SAFETY AND SECURITY sections for:

1. Conduit, junction boxes and wire pulls.
2. Connections to and from power supplies to electrified hardware.
3. Connections to fire/smoke alarm system and smoke evacuation system.
4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
5. Connections to panel interface modules, controllers, and gateways.
6. Testing and labeling wires with Architect's opening number.

K. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

L. Door Closers & Auto Operators: Mount closers/operators on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers/operators so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.

M. Overhead Stops/Holders: Mount overhead stops/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.

N. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.

O. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

P. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.

Q. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

R. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

S. Door Bottoms and Sweeps: Apply to bottom of door, forming seal with threshold when door is closed.

3.03 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Spring Hinges: Adjust to achieve positive latching when door can close freely from an open position of 30 degrees.
2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
3. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.

3.04 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items per manufacturer's instructions to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.05 DOOR HARDWARE SCHEDULE

A. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.

B. Discrepancies, conflicting hardware, and missing items are to be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application.

C. Hardware items are referenced in the following hardware schedule. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.

D. Hardware Sets: Please note that the Hardware Schedule has basis of design manufacturers listed. Approved equal manufacturers will be considered in accordance with Specification Section 01300 – Submittals.

Abbreviation	Name
BES	Best Locking Systems
IVE	H.B. Ives
LCN	LCN Commercial Division
SCH	Schlage Lock Company
VON	Von Duprin
ZER	Zero International Inc

98987 OPT0341470 Version 1

Legend:
↯ Electrified Opening

Hardware Group No. 01

For use on Door #(s):
D7.1 D7A.1 D7A.2

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	224HD	628	IVE
1	EA	PANIC HARDWARE	CD-98-L-06	630	VON
1	EA	RIM CYLINDER	1E72	626	BES
1	EA	MORTISE CYLINDER	1E74	626	BES
1	EA	PERMANENT CORE BY OWNER	SFIC	626	BES
1	EA	SURFACE CLOSER	4111 SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	BLK	IVE
1	SET	GASKETING	139A-S	A	ZER
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	HM DOOR BTM	355AA	AA	ZER
1	EA	H/C SADDLE THRESHOLD	545A-223	A	ZER

Hardware Group No. 02

For use on Door #(s):
D10A

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	3CB1 4.5 X 4.5	626	IVE
1	EA	PRIVACY LOCK	L9040 06A 09-544 L283-722	626	SCH
1	EA	SURFACE CLOSER	1450 HW/PA STD	689	LCN
1	EA	MOP PLATE	8400 4" X 2" LDW B-CS	626	IVE
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS401/402CCV	626	IVE
1	EA	SINGLE HOOK	507B	626	IVE

Hardware Group No. 03

For use on Door #(s):
D7A.3 D7A.4

Provide each RU door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	MORTISE CYLINDER	1E74	626	BES
1	EA	PERMANENT CORE BY OWNER	SFIC	626	BES

ALL OTHER HARDWARE BY DOOR MANUFACTURE

END OF SECTION

SECTION 09255 – GYPSUM BOARD ASSEMBLIES

1.1 GENERAL

A. Sound Transmission Characteristics: For gypsum board assemblies with STC ratings, provide materials and construction identical to those of assemblies whose STC ratings were determined according to ASTM E 90 and classified according to ASTM E 413 by a qualified independent testing agency.

B. Fire Resistance: Where fire resistance rated gypsum board assemblies are indicated, provide gypsum board assemblies that are identical to assemblies tested for fire resistant according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

C. Design framing systems in accordance with 2018 IBC New Jersey Edition and AISI S220.

1.2 SUBMITTALS

A. Evaluation Reports: Submit evaluation reports certified under an independent third-party inspection program administered by an agency accredited by IAS to ICC-ES AC98 accreditation criteria for inspection agencies.

B. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified in accordance with the product-certification program of the Steel Framing Industry Association (SFIA) or similar organization providing a verifiable code-compliance program.

C. Provide an index (table of contents) of job specific products, assemblies and reference the contract drawing details. Indicate on the manufacturer's cut sheets the specific products, gauge, etc. to be used (be specific).

1.3 PRODUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

1. Steel Framing and Furring:

a. ClarkDietrich
b. Marino/Ware (formerly Marino Industries Corp.).
c. Or approved equal.

2. Grid Suspension Assemblies:

a. Armstrong World Industries, Inc.
b. USG Interiors, Inc.
c. Or approved equal.

3. Gypsum Board and Related Products:

a. GP Gypsum, LLC
b. National Gypsum Co.; Gold Bond Building Products Division (NG).
c. United States Gypsum Co. (USG).
d. Or approval equal.

B. Steel Framing Components for Suspended and Furred Ceilings: Provide components complying with ASTM C 754 for conditions indicated.

1. Powder-Actuated Fasteners in Concrete: Corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E 1190.
2. Wire Ties: ASTM A 641 (ASTM A 641M), Class 1 zinc coating, soft temper, 0.062 inch (1.6 mm) thick.
3. Wire Hangers: ASTM A 641 (ASTM A 641M), Class 1 zinc coating, soft temper, 0.162-inch (4.1-mm) diameter.
4. Hanger Rods: Mild steel and zinc coated or protected with rust-inhibitive coating.
5. Flat Hangers: Mild steel and zinc coated or protected with rust-inhibitive coating.
6. Channels: Cold-rolled steel, 16 ga minimum thickness of base steel and 1/2- inch-(13-mm-) wide flanges, and as follows:

    a. Carrying Channels: 2 inches (50.8 mm) deep, 590 lb/1000 feet (88 kg/100 m), unless otherwise indicated.
    b. Finish: ASTM A 653, G 60 (ASTM A 653M, Z 180) hot-dip galvanized coating for framing for exterior soffits and where indicated.

C. Steel Studs for Furring Channels: AISI S220, in depth indicated and with 0.0179 inch (0.45 mm) minimum base steel thickness, unless otherwise indicated.

1. Protective Coating: Comply with AISI S220; ASTM A 653, G 40 (Z120); or coating with equivalent corrosion resistance of ASTM A653/A653M, G40 (Z120) hot-dip galvanized coating for framing for exterior soffits and ceiling suspension members in areas within 10 feet (3 m) of exterior walls. Galvannealed products are unacceptable.

    a. Coating to demonstrate equivalent corrosion resistance with an evaluation report acceptable to authorities having jurisdiction.

D. Steel Resilient Furring Channels: Standard product fabricated from steel sheet complying with ASTM A 653 (ASTM A 653M) to form ½-inch- (12.7-mm-) deep channel of the following configuration unless otherwise indicated:

1. Double-Leg Configuration: Hat-shaped channel with 1-1/2-inch- (38.1-mm-) wide face connected to flanges by double-slotted or expanded-metal legs (webs).
2. Single-Leg Configuration: Asymmetrical.

    a. Product: ClarkDietrich; RC Deluxe (RCSD) Resilient Channel or approved equal.

E. Grid Suspension System for Interior Ceilings: ASTM C 645, manufacturer's standard direct-hung system.

F. Steel Framing for Walls and Partitions: Provide a minimum of 20 gauge interior non-bearing steel framing members complying with the following requirements: (for all bearing walls refer to structural drawings)

1. Protective Coating: Comply with AISI S220; ASTM A 653, G 40 (Z120) or coating with equivalent corrosion resistance of ASTM A653/A653M, G40 (Z120), hot-dip galvanized coating for framing members attached to and within 10 feet (3 m) of exterior walls. Galvannealed products are unacceptable.

   a. Coating to demonstrate equivalent corrosion resistance with an evaluation report acceptable to authorities having jurisdiction.

2. Steel Studs and Runners: AISI S220 in depth indicated 20 gauge minimum base steel thickness, unless otherwise indicated.

   a. Product: ClarkDietrich; ProSTUD Drywall Framing System ProSTUD 30 (0.0296 inch – 0.7518 mm) for typical walls and ProSTUD 33 (0.0329 inch – 0.8382 mm) for tile walls with Smart Edge technology and with DiamondPlus® Coating or approved equal.

INTERIOR NON-BEARING GYPSUM STUD PARTITION HEIGHT LIMITATION & GAUGE TABLE

INTERIOR NON-BEARING GYPSUM STUD PARTITION			
1 5/8" STUD 16" o.c.	2 1/2" STUD 16" o.c.	3 5/8" STUD 16" o.c.	6" STUD 16" o.c.
	18 GA. UP TO 12'- 6"	18 GA. UP TO 16'- 6"	16 GA. UP TO 22'- 0"
20 GA, UP TO 8'- 10"	20 GA. UP TO 11'- 6"	20 GA. UP TO 15'- 0"	
SEE STRUCTURAL DRAWINGS FOR OTHER FRAMING GAUGE & SIZE			

G. Steel Rigid Furring Channels: AISI S220, hat shaped, in depth indicated and with 0.0296 inch (20 gauge), minimum base steel thickness unless otherwise indicated.

   1. Product: ClarkDietrich; Furring Channel or approved equal.

H. Fasteners for Metal Framing: Type, material, size, corrosion resistance, holding power, and other properties required to fasten steel framing and furring members securely to substrates involved; complying with the recommendations of gypsum board manufacturers for applications indicated.

I. Gypsum Board Products: Types indicated in maximum lengths available that will minimize end-to-end butt joints in each area indicated to receive gypsum board application.

1. Gypsum Wallboard: ASTM C 1396, C 1178, C 1658, in thickness indicated.

a. Type: Regular for vertical surfaces. (ToughRock® Mold-Guard™ by GP Gypsum or approved equal), unless otherwise indicated.
b. Type: Type X where required for fire-resistance-rated assemblies.
c. Type: For ceiling surfaces (ToughRock® Mold-Guard™ by GP Gypsum or approved equal), unless otherwise indicated.
d. Type: Moisture and mold resistant gypsum panel for wet locations without tile surfaces (ToughRock® Mold-Guard™, DensArmor Plus® interior panel by GP Gypsum, Gold Bond Brand XP Gypsum Board by NG, Fiberock Aqua-Tough Interior panel by USG, or approved equal).
e. Type: Water and mold resistant with tile surfaces. (DensShield® Tile Backer by GP Gypsum or approved equal)
f. Type: Proprietary type as required for specific fire-resistance-rated assemblies.
g. Type: Impact/Abuse Resistant. (Gold Bond High Impact XP by NG or approved equal)
h. Type: Sound Resistant. (Gold Bond Soundbreak XP by NG or approved equal)

2. Proprietary Gypsum Board Products: Subject to compliance with requirements, provide one of the following products or approved equal where proprietary gypsum wall board is indicated:

a. ToughRock® Fireguard® C, DensArmor Plus® Type C, by GP Gypsum or approved equal
b. Fire Shield G; National Gypsum Company; Gold Bond Building Products Division.
c. SHEETROCK Brand Gypsum Panels, FIRECODE C Core; United States Gypsum Company.
d. SHEETROCK Brand Gypsum Panels, ULTRACODE Core; United States Gypsum Company.
e. Or approved equal.

J. Gypsum Board Base Layer(s) for Multilayer Applications: ASTM C 1396 in thickness indicated:

1. Type: Type X where indicated or required for fire-resistance-rated assemblies.
2. Type: Sag-resistant type for ceiling surfaces, unless otherwise indicated.

K. Accessories for Interior Installations: Cornerbead, edge trim, and control joints complying with ASTM C 1047, formed metal or plastic, with metal complying with the following requirement:

1. Steel sheet zinc added space coated by hot dip proceed or rolled zinc.

L. Joint Treatment Materials: Provide joint treatment materials complying with ASTM C 475 and the recommendations of both the manufacturers of sheet products and of joint treatment materials for each application indicated.

1. Joint Tape for Gypsum Board: Paper reinforcing tape, unless otherwise indicated.

a. Use pressure-sensitive or staple-attached, open-weave, glass-fiber reinforcing tape with compatible joint compound where recommended by manufacturer of gypsum board and joint treatment materials for application indicated.

1) Product: ClarkDietrich; Strait-Flex Butt-Tape, or approved equal.

2. Setting-Type Joint Compounds for Gypsum Board: Factory-packaged, job- mixed, chemical-hardening powder products formulated for uses indicated.

a. For prefilling gypsum board joints, use formulation recommended by gypsum board manufacturer.
b. For filling joints and treating fasteners of water-resistant gypsum backing board behind base for ceramic tile, use formulation recommended by gypsum board manufacturer.
c. For topping compound, use sandable formulation.

3. Drying-Type Joint Compounds for Gypsum Board: Factory-packaged vinyl-based products complying with the following requirements for formulation and intended use.

a. Ready-Mixed Formulation: Factory-mixed product.

1) Taping compound formulated for embedding tape and for first coat over fasteners and face flanges of trim accessories.
2) All-purpose compound formulated for both taping and topping compounds.

M. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 that is effective in reducing the airborne transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E90.

N. Miscellaneous Materials: Provide auxiliary materials for gypsum board construction that comply with referenced standards and recommendations of gypsum board manufacturer.

1. Laminating Adhesive: Special adhesive or joint compound recommended for laminating gypsum panels.
2. Spot Grout: ASTM C 475, setting-type joint compound recommended for spot-grouting hollow metal door frames.
3. Fastening Adhesive for Metal: Special adhesive recommended for laminating gypsum panels to steel framing.
4. Steel drill screws complying with ASTM C 1002 for the following applications:

a. Fastening gypsum board to steel members less than 0.033 inch (0.84 mm) thick.
b. Fastening gypsum board to gypsum board.

5. Steel drill screws complying with ASTM C 954 for fastening gypsum board to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
6. Foam Gaskets: Closed-cell vinyl foam adhesive-backed strips, that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit metal stud size indicated.
7. Sound-Attenuation Blankets: Unfaced mineral-fiber blanket insulation to comply with ASTM C 665 for Type I.
8. Polyethylene Vapor Retarder: ASTM D 4397, thickness and maximum permeance rating as follows:

   a. 6 mils (0.15 mm), 0.13 perms (7.5 ng/Pa x s x sq. m).

9. Vapor Retarder Tape: Pressure-sensitive tape of type recommended by vapor retarder manufacturer for sealing joints and penetrations in vapor retarder.

1.4 EXECUTION

A. Install steel framing to comply with ASTM C 754 and with ASTM C 840 requirements that apply to framing installation.

1. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
2. Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement.

   a. Where building structure abuts ceiling perimeter or penetrates ceiling.
   b. Where partition framing and wall furring abut structure, except at floor.

3. Do not bridge building control and expansion joints with steel framing or furring members. Independently frame both sides of joints with framing or furring members as indicated.

B. Installing Steel Framing for Suspended and Furred Ceilings: as follows:

1. Sway-brace suspended steel framing with hangers used for support.
2. Install suspended steel framing components in sizes and at spacings indicated, but not less than that required by the referenced steel framing installation standard.
3. Grid Suspension System: Attach perimeter wall track or angle where grid suspension system meets vel iical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

C. Installing Steel Framing for Walls and Partitions: Install steel studs and furring at spacings indicated.

1. Where studs are installed directly against exterior walls, install asphalt felt strips or foam gaskets between studs and wall.

2. Extend partition framing full height to structural supports or substrates above suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.
3. Cut studs 1 inch short of full height to provide perimeter relief.
4. All interior walls are STC-rated and some are fire-resistance-rated partitions that extend to the underside of floor/roof slabs and decks or other continuous solid structural surfaces to obtain ratings, install framing around structural and other members extending below floor/roof slabs and decks, as needed, to support gypsum board closures needed to make partitions continuous from floor to underside of solid structure.
5. Frame door openings to comply with GA-219, and with applicable published recommendations of gypsum board manufacturer, unless otherwise indicated.
6. Frame openings other than door openings to comply with details indicated or, if none indicated, as required for door openings. Install framing below sills of openings to match framing required above door heads.

D. Gypsum Board Application and Finishing Standards: Install and finish gypsum panels to comply with ASTM C 840 and GA-216.

1. Install sound-attenuation blankets prior to installing gypsum panels unless blankets are readily installed after panels have been installed on one side.
2. Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
3. Spot grout hollow metal door frames for solid-core wood doors, hollow metal doors, and doors over 32 inches (813 mm) wide. Apply spot grout at each jamb anchor clip and immediately insert gypsum panels into frames.
4. Form control and expansion joints at locations indicated and as detailed, with space between edges of adjoining gypsum panels, as well as supporting framing behind gypsum panels.
5. Isolate perimeter of nonload-bearing gypsum board partitions at structural abutments, except floors, as detailed. Provide 1/4- to ½-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
6. All walls are STC-rated gypsum board assemblies. Seal construction at perimeters, behind control and expansion joints, openings, and penetrations with a continuous bead of acoustical sealant including a bead at both faces of the partitions. Comply with ASTM C 919 and manufacturer's recommendations for location of edge trim and closing off sound-flanking paths around or through gypsum board assemblies, including sealing partitions above acoustical ceilings.
7. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's recommendations.

    a. Space screws a maximum of 12 inches (304.8 mm) o.c. for vertical applications or as required by fire resistive design.

8. Space fasteners in panels that are tile substrates a maximum of 8 inches (203.2 mm) o.c.
9. Install water resistant gypsum backing board panels at sink and where indicated.

Install with 1/4-inch (6.4-mm) open space where panels abut other construction or penetrations.

10. Single-Layer Fastening Methods: Apply gypsum panels to supports as follows:

    a. Fasten with screws.

11. Multilayer Fastening Methods: Apply base layers of gypsum panels and face layer to base layers as follows:

    a. Fasten both base layers and face layers separately to supports with screws.

E. Installing Trim Accessories: For trim accessories with back flanges, fasten to framing with the same fasteners used to fasten gypsum board. Otherwise, fasten trim accessories according to accessory manufacturer's directions for type, length, and spacing of fasteners.

1. Install cornerbead at external corners.
2. Install edge trim where edge of gypsum panels would otherwise be exposed. Provide edge trim type with face flange formed to receive joint compound, except where other types are indicated.

    a. Install LC-bead where gypsum panels are tightly abutted to other construction and back flange can be attached to framing or supporting substrate.
    b. Install L-bead where edge trim can only be installed after gypsum panels are installed.
    c. Install U-bead where indicated.
    d. Install control joints according to ASTM C 840 and manufacturer's recommendations and in specific locations approved by Architect for visual effect.

F. Finishing Gypsum Board Assemblies: Treat gypsum board joints, interior angles, flanges of cornerbead, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration.

1. Prefill open joints, rounded or beveled edges, and damaged areas using setting-type joint compound.
2. Apply joint tape over gypsum board joints, except those with trim accessories having flanges not requiring tape.
3. Levels of Gypsum Board Finish: Provide the following levels of gypsum board finish per GA-214-15.

    a. For all areas provide Level 4 finish for gypsum board surfaces.

4. For Level 4 gypsum board finish, embed tape in joint compound and apply first, fill (second), and finish (third) coats of joint compound over joints, angles, fastener heads, and accessories. Touch up and sand between coats and after last coat as needed to produce a surface free of visual defects and ready for decoration.
5. Finish water-resistant gypsum backing board to comply with ASTM C 840 and gypsum board manufacturer's directions.

END OF SECTION 09255

SECTION 09300 – CERAMIC TILE

1.1 General

A. ANSI Tile Standards: Comply with ANSI A137.1 Standard Specification for Ceramic Tile and ANSI 108 series of tile installation standards included under "American National Standard Specifications for the Installation of Ceramic Tile."

B. TCNA Installation Guidelines: The current edition of the TCNA "Handbook for Ceramic, Glass, and Stone Tile Installation"; comply with TCNA installation method F112 for recessed wet set floor construction, W223and W202I for interior wall construction.

C. Submittals: With manufacturer's product data and installation instructions for tile work, submit samples of each type, color, and texture of tile mounted on 12-inch-square backing with joints grouted.

D. Attic Stock: Provide 5 percent of amount installed, packaged with protective covering for storage, and identified with labels clearly describing contents, before installation begins. Furnish attic stock: Furnish not less than 1 box for each 50 boxes or a fraction thereof, of each type, color, pattern, and size as installed.

1.2 Products

A. Colors, Textures, and Patterns: For tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, comply with the following requirements:

1. Provide selections made by Architect from manufacturer's full range of standard colors, textures, and patterns for products of type indicated.
2. The Architect may use multiple color patterns.

B. Sizes and Thicknesses: 4 ¼" x 4 ¼" x 5/16" thick for wall tiles. 2" x 2" x ¼" thick for all floor tiles.

C. Tile Grade: Provide category one and two standard grade color selection samples for field use and up to category four color selection samples for accent tiles. When the Contract Documents call to match existing tile, the Contractor shall include "color match" by QTCO distributed by Daltile or approved equal.

D. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating them with a continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

E. Unglazed Ceramic Mosaic Floor Tile: Factory-mounted flat tile and as follows:

1. Composition: Porcelain with abrasive admixture.
2. Face: Standard design with cushion edges.

F. Glazed Wall Tile: Factory-mounted flat tile and as follows:

1. Face: Plain with cushion edge.
2. Mounting: Back-mounted.

G. Backer Board: Provide ¼" thick cement backer board at all existing CMU wall surfaces to receive new ceramic tile finish. Backer boards shall be fabricated with 90% Portland cement and sand mixture to resist damage from moisture. Formulation and structure must provide strength, uniform composition and excellent tile adhesion. Provide HardieBacker by James Hardie or approved equal.

H. Trim Shapes: Same material, size, color, and texture as field tile. Provide cove base, inside and outside vertical coves and beads.

I. Marble Thresholds: Group "A"; ASTM C 503, for exterior use with minimum hardness of 10.0 per ASTM C 241; white with honed finish unless otherwise indicated.

J. Surface Preparation Materials: Provide surface preparation materials as follows:

1. Trowelable Floor/Wall Patch and Render Mortar: Quick-Setting, Polymer-Modified, Fiber-Reinforced, Cementitious Rendering, Patching, and Leveling Mortar, can be applied at 1/8 inch to 1-1/4 inch (3 mm to 32 mm).

   a. Product: MAPEI, Planitop 330 Fast.
   b. Or approved equal

2. Trowelable Concrete Floor Patch: High-Performance, Fast-Setting Cementitious Patching Compound. Can be applied at 1/16 inch to 1-1/2 inches (1.5 mm to 38 mm) neat and from 1-1/2 inches to 3 inches (38 mm to 76 mm) neat in areas no larger than 24 sq ft (2.23 sq m).

   a. Product: MAPEI, Mapecem Quickpatch.
   b. Or approved equal

K. Self-Leveling Underlayments: Provide self-leveling underlayments as follows:

1. Quick-Setting, Hydraulic Cement Underlayment: Polymer-modified, self-leveling, hydraulic cement. Applied Minimum Uniform Thickness: 1/8 to 1 inch (3 to 25 mm).

   a. Product: MAPEI, Novoplan 2 Plus.
      1) Primer required: MAPEI, Primer T.
      2) or approved equal

L. Waterproof and Crack Isolation Membranes: Provide Waterproof and Crack Isolation membranes as follows:

1. Fluid-Applied Membrane: Advanced liquid-rubber; extremely quick-drying, premium waterproofing and crack- isolation membrane, IAPMO-listed, ANSI A118.10 and A118.12.

a. Product: MAPEI, Mapelastic AquaDefense. (or approved equal)
1) With MAPEI, Reinforcing Fabric (or approved equal)

M. Setting Materials: Provide setting materials as follows:

1. Portland Cement Mortar: Materials complying with ANSI A 108.1 and as follows:

a. Latex additive (water emulsion) as follows, replacing part or all of gauging water, specifically recommended by latex additive manufacturer for use with job-mixed portland cement and aggregate mortar bed.

1) Latex Additive: Manufacturer's standard.
a) Product: MAPEI, Planicrete AC.
b) Or approved equal

2. Dry-Set Portland Cement Mortar: ANSI A118.1.

3. Latex-Portland Cement Mortar: ANSI A118.4.

a. Prepackaged dry mortar mix composed of portland cement, graded aggregate, and the following dry polymer additive in the form of a reemulsifiable powder to which only water is added at job site.

1) Dry Polymer Additive: Manufacturer's standard.
a) Product: MAPEI, Ultraflex 2.
b) Or approved equal

4. Improved Modified Dry-Set Cement Mortar: Non-Sag, for Large and Heavy Tile; ANSI A118.4HTE, ANSI A118.11, ANSI A118.15HTE, and ISO 13007 C2TES1P1.

a. Product: MAPEI Ultraflex LFT.
b. Or approved equal

5. Improved Modified Dry-Set Cement Mortar: ANSI A118.4E, ANSI A118.11, ANSI A118.15E, and ISO 13007 C2ES2P2.

a. Product: MAPEI Kerabond and Keralastic System
b. or approved equal

6. Latex additive as described below, replacing part or all of gauging water, combined at job site with prepackaged dry mortar mix specified by latex additive manufacturer.

a. Latex Type: Manufacturer's standard.
1) Product: MAPEI, Kerabond/Keralastic System.
2) Or approved equal

7. Organic Tile Adhesive: ANSI A136.1, Type I.

N. Grouting Materials: Provide grouting materials as follows:

1. Latex-Portland Cement Grout: ANSI A118.6 of the following composition.

a. Latex additive (water emulsion) replacing part or all of gauging water, added at job site with dry grout mixture, with type of latex and dry grout mix as follows:
1) Latex Type: Manufacturer's standard.
2) Dry Grout Mixture: Commercial portland cement specified or supplied by latex additive manufacturer.

2. High Performance Cement Tile Grout: For grout joints from 1/16 to 3/4 inch (1.5 to 19 mm) and meeting ANSI A118.7 and ISO 13007 CGWAF.

a. Product: MAPEI; Ultracolor Plus FA.
b. Or approved equal

3. Commercial Industrial Grade Water-Cleanable Epoxy Grout: For grout joints from 1/8 to 5/8 inch (3 to 16 mm), ANSI A118.3 and ISO 13007 RG.

a. Product: MAPEI, Kerapoxy IEG CQ. Or approved equal
b. Provide product with a VOC content of 65000 ppm (65 grams per L) or less when calculated according to 40 CFR 59, Subpart D.
c. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 degrees F (60 degrees C) and 212 degrees F (100 degrees C), respectively, and certified by manufacturer for intended use.

O. Elastomeric Sealants: Manufacturer's standard chemically curing, elastomeric sealants of base polymer indicated that comply with requirements of Division 7 Section "Joint Sealers" including ASTM C 920 as referenced by Type, Grade, Class, and Uses.

1. One-Part Mildew-Resistant Silicone Sealants: ASTM C 920, Type S, Grade NS, Class 25, Uses NT, G, A, and O (for use in joints in nontraffic areas).

a. Product: MAPEI; Mapesil T.
b. Or approved equal

P. Miscellaneous Materials: Provide the following materials:

1. Metal Edge Strips: Stainless steel or zinc alloy, 1/8-inch wide at top edge.

2. Temporary Protective Coating: As follows, formulated to protect exposed surfaces of tile against adherence of mortar and grout, compatible with tile and mortar/grout products, and easily removable without damaging grout or tile.

a. Petroleum paraffin wax, fully refined, tasteless, odorless, containing at least 0.5 percent oil, with a melting point of 120 deg F (49 deg C) to 140

deg F (60 deg C) per ASTM D 87.

3. Sulfamic Acid Crystals: Cleaner and problem-solver for nonporous, acid-resistant tile and natural stone. Removes cured cement grout haze, mortar residue, rust stains and mineral deposits such as efflorescence.

   a. Product: MAPEI, UltraCare Sulfamic Acid Crystals.
   b. Or approved equal

4. Grout release: high-performance sacrificial coating that protects the tile surface from grout stains, improves cleanability and reduces the risk of grout haze or film residue, interior and exterior applications on all-natural stone; marble, limestone, sandstone, slate, granite and travertine, porcelain/ceramic tiles, masonry and quarry tiles.

   a. Product: MAPEI, UltraCare Grout Release.
   b. Or approved equal

5. Solvent-Based Penetrating Sealer: Natural-look providing maximum protection against most common stains. For use on interior and exterior natural stone; marble, limestone, sandstone, slate, granite, travertine, unglazed porcelain and ceramic tiles, masonry, quarry tiles and cement grout. Can also be used as a pre-grouting sealer.

   a. Product: MAPEI, UltraCare Penetrating SB Stone, Tile and Grout Sealer.
   b. Or approved equal

6. Neutral pH Cleaner: Highly concentrated, zero-VOC, for ceramic, porcelain and natural stone surfaces and prevent soap scum buildup and hard water deposits.

   a. Product: MAPEI, UltraCare Concentrated Tile and Grout Cleaner.
   b. Or approved equal

7. High-Alkaline Cleaner: Highly concentrated and degreaser that quickly removes waxes, grease, oil, light soap scum, mildew and algae stains. For areas that have been neglected or subject to heavy use.

   a. Product: MAPEI, UltraCare Heavy-Duty Stone, Tile and Grout Cleaner.
   b. Or approved equal

1.3 Execution

A. Field-Applied Temporary Protective Coating: Where indicated under or needed to prevent adhesion or staining of exposed tile surfaces by grout, precoat tile with a continuous film of temporary protective coating indicated below:

   1. Petroleum paraffin wax.

B. Installation: Follow TCNA Installation Guidelines. TCNA "Handbook for Ceramic Tile

Installation"; comply with TCNA installation method F112-2007, F113-2007 for recessed wet set floor construction, W202-2007, W223-2007 for wall construction.

C. Existing Floor Preparation: Assume that major floor preparation and leveling will be required on concrete subfloor. Provide positive slope to the floor drain. Assume that up to 1 ½" of leveling may be required on existing concrete subfloor.

D. Joint Pattern: Use grid pattern with 1/16-inch-wide joints unless otherwise indicated.

E. Expansion, Control, Contraction, and Isolation Joints: As indicated per TCNA Method EJ171.

1. Seal tile joints with elastomeric sealants to comply with Division 7 Section "Joint Sealers."

F. Edge Strips: Provide at exposed edge of tile meeting carpet, wood, or resilient flooring, unless otherwise indicated.

G. Cleaning: Upon completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove latex-portland cement grout residue from tile as soon as possible.
2. Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's printed instructions but no sooner than 14 days after installation. Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning.
3. Remove temporary protective coating, by method recommended by coating manufacturer that is acceptable to brick and grout manufacturer. Trap and remove coating to prevent it from clogging drains.
4. Floor drain: Slope setting mortar bed to floor drain for positive water flow. Remove and clean the drain cover after grouting and final cleaning.

END OF SECTION 09300

SECTION 09510 - ACOUSTICAL CEILINGS

PART-1 GENERAL

1.01 Summary:

A. This Section includes acoustical ceilings consisting of suspended exposed-grid systems with lay-in acoustical panels.

1.02 Submittals:

A. Product Data: Manufacturer's complete technical descriptive literature for each item required, including specifications and installation recommendations.

B. Coordination Drawings: Reflected ceiling plans draw n to scale and coordinating penetrations and ceiling-mounted items. Within 60 days after award of Contract, submit coordination drawings for all new or altered areas, draw n accurately to a scale no less than 1/8" = 1 ' - O ", coordinating penetrations and ceiling-mounted items. Coordinate with other prim e contractors to obtain necessary information and agreement on location of penetrations and ceiling-mounted items. Upon review and acceptance by Architect, incorporate revisions (if any) into an AutoCAD -based file. Furnish one hard copy of accepted shop drawings and one updated CAD-file copy to all other applicable prim e contractors for their further information and use. Show the following:

1. Ceiling suspension system members.
2. Method of attaching hangers to building structure.
3. Bulkheads, soffits, areas with drywall ceilings (if any), and areas of exposed structure (if any).
4. Room names and numbers, ceiling types, and ceiling elevations above the finished floor.
5. Special moldings at walls, column penetrations, and other junctures with adjoining construction, including all curved walls and bulkheads.
6. Ceiling-mounted items, including light fixtures; HVAC air distribution devices; speakers; fire alarms; sprinkler heads; and other similar devices or fixtures.

C. Shop Drawings: Show details and information pertinent to construction, installation, and placement of all components required for continuous, smooth wall angles at curved walls, bulkheads and circular columns. Include sections of typical curved wall angle.

1.03 Quality Assurance:

A. Installer Qualifications: Engage an experienced installer who has completed acoustical tile ceilings and finishes similar in material, design, and extent to that indicated for this Project and with a minimum five-year record of successful in-service performance.

B. Source Limitations for Ceiling Units: Obtain all acoustical panel and grid systems from one single source.

1.04 Delivery, Storage and Handling:

A. Deliver acoustical materials and suspension system components to Project site in

original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other detrimental conditions.

B. Before installing acoustical materials, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical tiles and panels carefully to avoid chipping edges or damaging units in any way.

1.05 Project Conditions:

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. The work area shall be broom clean and the structure in proper condition to receive acoustical materials. Acoustical work shall follow the installation of ductwork, piping and conduit located in ceiling space above ceilings.

1.06 Coordination:

A. Coordinate layout and installation of acoustical materials and suspension systems with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.07 Extra Stock:

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

1. Acoustical Ceiling Units:

a. ACT Type A: One extra carton of full-size units of each type.

PART-2 PRODUCTS

2.01 Acoustical Ceilings. General:

A. Humidity Resistance: Unless indicated otherwise, ceiling panels shall be rated for 90% humidity conditions and shall have a 10-year sag- and warp-resistance warranty, comparable to Armstrong's "HumiGuard Plus" or approved equal.

B. Acoustical Ceiling Colors: Manufacturer's standard white, unless indicated otherwise.

C. Fire-Test-Response Characteristics: Provide ceilings (ceiling panels/tiles, grids and accessories) that comply with the following requirements:

1. Fire-response tests were performed by UU, ITS/Wamock Hersey, or another independent testing and inspecting agency that is acceptable to authorities having jurisdiction and that performs testing and follow-up services.
2. Surface-burning characteristics of acoustical panels shall comply with ASTME 1264 for Class A materials as determined by testing identical products per ASTME 84.

D. Dimensions: Length by width dimensions for lay-in ceiling panels are nominal dimensions. Actual dimensions are to be factory-cut sizes that fit within suspended ceiling grids having standard modular dimensions matching the specified panel nominal length and width.

2.02 Acoustical Ceiling Systems:

A. ACT-A: 24 in. x 48 in. x 7/8 in. lay-in panels with square edge profile; wet-formed panel composed of mineral fiber with a factory-applied, vinyl latex paint finish; minimum light reflectance (LR) rating of 0.84; minimum ceiling attenuation class (CAC) of 40; and minimum noise reduction coefficient (NRC) of 0.70. Suspension system - Type A.

1. Subject to compliance with requirements, provide one of the following panel products:

a. Armstrong World Industries; School Zone Fine Fissured #1714
b. Certainteed; Sereno Fine Fissured #SFF-497 HNRC/HCAC
c. USG Interiors; Radar Clima Plus, High-NRC #22441
d. or approved equal

2.03 Suspension Systems:

A. General: Unless indicated otherwise, suspension grids shall comply with ASTMC 635 "Intermediate Duty" Classification.

B. Suspension System Types:
1. Type A: Exposed grid system with 15/16 in. wide face, shall be HDG steel, Class A Fire Rated, White.

C. Suspension System Accessories: Provide all accessories necessary to complete installation, including, but not limited to, the following:

1. Preformed, factory-finished, bull-nosed comers to match grid material and finish. Provide comers w here grid meets bull-nosed block.
2. Provide impact clips at toilet room and gymnasium ceilings.
3. Provide retention clips for ceilings located in wind locks and vestibules.
4. Provide white, dual durometer polyvinylchloride (PVC) bellow s-style filler for 1-inch expansion joints in suspended lay-in acoustical ceilings, selected from the following options:

a. Allway HC/HC W Series; Construction Specialties, Inc.
b. DX Series; M M Systems Corp.
c. Wabo Fast Wrap CES Series; Watson Bowman Acme Corp.
d. or approved equal

PART-3 EXECUTION

3.01 Ceiling Installation:

A. Suspend main beams spaced at 24 in. or 48 in. o.c., as indicated on Drawings, from structure above by minimum #12 gauge galvanized wire hangers spaced not more than 48 in. o.c.

B. Install interlocking cross-tees at 24 in. o.c. to form a 24 in. x 48 in., or 24 in. x 24 in. grid pattern.

C. System shall be accurately leveled to within 1/8 in. in 12 ft. 0 in. Deflection shall not exceed 1/360 of the span of any component.

D. Provide matching perimeter molding around separate room areas, abutting walls, and around columns and similar protrusions, unless indicated otherwise.

1. At radiused bulkheads and walls, provide curved wall angle, factory-formed to match diameter of bulkheads and walls; aluminum, finished to match ceiling grid. Field cut and formed edges made up of straight sections will not be permitted.

E. Where perimeter molding meets expansion joint trim, provide a clear break in the molding equal to no less than the expansion joint width.

F. Scribe and cut panels at borders and penetrations to provide a neat, precise fit. Coordinate with work of HVAC, plumbing and electrical trades.

302 Cleaning:

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 09653 - RESILIENT WALL BASE AND ACCESSORIES

PART 1 GENERAL

A. Submittals: As follows:

1. Product Data: For each type of product specified.
2. Samples: In manufacturer's standard sizes of each product color and pattern specified.

B. Extra Materials: Furnish not less than 10 linear feet (3 linear m) for each 500 linear feet (150 linear m) or fraction thereof, of each different type, color, pattern, and size of resilient product installed. Deliver extra materials to Owner.

PART 2 PRODUCTS

A. Manufacturers

1. Basis-of-Design: Roppe Corporation, 1602 N Union St., Fostoria, OH 44830. P: (800) 537 – 9527
2. Johnsonite
3. or Approved Equal

B. Rubber Cove Wall Base : Pinnacle – Rubber, Vulcanized Thermoset, Standard Toe, 6" high x 1/8" thick, Style B, Cove, Color shall be the manufacturer's standard choices.

C. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by resilient product manufacturer for applications indicated.

D. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

PAT 3 EXECUTION

A. Examine substrates, areas, and conditions where installation of resilient products will occur, with Installer present, for compliance with manufacturer's requirements, including those for maximum moisture content. Verify that substrates and conditions are satisfactory for resilient product installation and comply with requirements specified. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Preparation: Comply with manufacturer's written installation instructions for preparing substrates indicated to receive resilient products.

C. Installation: Install resilient products according to manufacturer's written installation instructions.

1. Apply resilient wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

a. Install wall base in lengths as long as practicable without gaps at seams and

with tops of adjacent pieces aligned.

b. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

c. Do not stretch base during installation.

d. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.

e. Form corners on job, from straight pieces of maximum lengths possible, without whitening at bends.

2. Place resilient products so they are butted to adjacent materials and bond to substrates with adhesive. Install reducer strips at edges of flooring that would otherwise be exposed.

D. Clean and protect resilient products according to manufacturer's written recommendations. Clean resilient products after installation and not more than 4 days before dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project.

END OF SECTION 09653

SECTION 09670 - FLUID APPLIED FLOORING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Provide labor and materials for a seamless, water based epoxy floor coating system including surface preparation, primers and finish coats.

1.02 ACCEPTABLE MANUFACTURERS AND INSTALLERS - Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

A. Sherwin Williams – ARMORSEAL 8100, color as selected by Owner
B. or approved equal

1.03 DELIVERY, STORAGE AND HANDLING

A. Deliver material to a job site in clean, clearly labeled containers and inspect prior to start of job.
B. Store material in a dry, enclosed area protected from the elements. Keep temperature of storage area between 60° and 90° F.

1.04 SUBMITTALS

A. System Data: Submit manufacturer's specifications on cured system and individual components of the water based Epoxy Flooring System, including physical properties and performance properties and tests described in Part 2.01 and submit Material Safety Data Sheets. Each individual component of the system will be evaluated on the basis of these standards. For any tests not listed in the manufacturer's standard nationally published data, the manufacturer must supply the missing data accompanied by the independent testing laboratory's test results which prove compliance in accordance with the referenced standard(s). Manufacturer's standard color chart shall also be submitted and colors and computerized custom color matching shall be available upon request.

B. The contractor shall submit a 6" x 6" cured system sample which the contractor has made for verification purposes and finish texture approval.

C. Contractor Experience: The contractor shall furnish a list of projects using either specified material or equivalent that they have installed during the last five (5) years. Information shall include: project name, square footage, owner contact name with Owner's address and phone number. Also, the contractor shall furnish resumes detailing the experience of key project personnel including supervisors and mechanics.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Verify supply of adequate utilities, including electric, water, heat (between 60° and 90° F.) and lighting of no less than 80 ft candles measured at floor surface.
B. Free work area of other trades during, and for a period of 24 hours, after floor installation.
C. Protect finished floor from damage by subsequent trades.

1.06 WARRANTY

A. Submit a two (2) year warranty against defects in material and workmanship upon Substantial Completion of installation.

PART 2 - PRODUCTS

2.01 PRODUCT DESCRIPTION

A. A Multiple Component, Seamless, Heavy Duty, Slip Resistant water based Epoxy Floor System. Subject to compliance with requirements, provide products by Sherwin Williams ArmorSeal 8100 water based epoxy floor coating (color as selected by Owner) or approved equal.

2.02 PHYSICAL PROPERTIES

Test Name	Test Method	Results
Abrasion Resistance	ASTM D4060, CS17 wheel, 1000 cycles, 1 kg load	150 mg loss
Adhesion	ASTM D4541	550 psi concrete
Finish	Satin Gloss	15-25 units@ 85° 90+ units @ 60°
Flexibility	ASTM D 522	180° bend 1/8" mandrel
Impact Resistance	ASTM D2794	Direct 100 in.lb. Indirect 80 in.lb.
Pencil Hardness	ASTM D3363	H
Slip Resistance, Floors	ASTM C1028**, .60 Minimum Static Coefficient of Friction	Passes wet and dry, with and without SharkGrip Additive
WVP Perms (US)	Grains(hr ft2 in Hg)	Gloss – 2.0 Satin – 5.0
Hot Tire Pick-up	ITM @ 140°F (60°C)	Passes

**Test method withdrawn in 2014 without replacement

Property	Test Method	Result
Coefficient of Friction	ASTM C-1028	
Standard Slip-Resistant		N/A
Orange Peel		
Smooth		0.5
VOC Content	EPA Method 24	0g/1 L50 g/1

A. Epoxy Floor

Dry MILS	**Concrete Floor, unpainted**
4.0 MILS	First Coat: 1ct. ArmorSeal 8100 - B70-8160 Series or approved equal (reduced with one pint of water per gallon)
4.0 MILS	Second Coat: ArmorSeal 8100 - B70-8160 Series or approved equal with color tint

2.03 PRODUCT MIXING

A. Mix on site with manufacturer supplied mix and measure apparatus to ensure a timely, accurate mix ratio and minimize waste.

PART 3 - EXECUTION

3.01 PREPARATION

A. Adhere strictly to manufacturer's current written instructions
B. Remove existing VCT flooring and mastic.
C. Inspection of the concrete substrate
D. Removal and replacement of non-durable concrete
E. Decontamination of the concrete surface, verify that surface is dry and perfectly clean, free of all oil, grease, detergent, film, sealers and/or curing compounds.
F. Create a surface profile with a grinding machine and dust-free diamond grinders for edges.
G. Repair of surface irregularities.
H. Do not use hydrocarbon solvents for cleaning.

3.02 INSTALLATION

A. Adhere strictly to manufacturer's current written instructions.
B. Apply a base coat at 4.0 MILS.
C. Apply a second coat at 4.0 MILS

3.03 DETAILS

A. Thoroughly route and vacuum moving cracks and joints, then fill with ARMORSEAL.
B. Pre-patch non-moving surface deviations with patching compound comprised of 100% solids epoxy and aggregate.
C. "Key in"all drains, edges and transition points according to manufacturer's instructions.

END OF SECTION

SECTION 09900 – PAINTING

1.1 GENERAL

A. This Section includes surface preparation and field painting of exposed exterior and interior items and surfaces.

1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. Block fill prime paint all CMU walls full height to the roof deck above ceiling and behind all built in casework, lockers, etc. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Architect will select from standard colors and finishes available.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

1. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

D. Submittals: For each paint system specified, provide the following:

1. Material List: Provide an inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
2. Manufacturer's Information: Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.

E. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for each type of finish-coat material indicated. After color selection, the Architect will furnish color chips for surfaces to be coated.

F. Samples for Verification: Of each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.

1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
2. Provide a list of materials and applications for each coat of each sample. Label each sample for location and application.
3. Submit Samples on the following substrates for the Architect's review of color and texture only:
   a. Concrete: Provide two 4-inch- (100-mm-) square samples for each color and finish.
   b. Concrete Masonry: Provide two 4-by-8-inch (100-by-200-mm) samples of masonry for each finish and color.
   c. Stained or Natural Wood: Provide two 4-by-8-inch (100-by-200-mm)

samples of natural- or stained-wood finish on actual wood surfaces.

d. Ferrous Metal: Provide two 4-inch- (100-mm-) square samples of flat metal and two 8-inch- (200-mm-) long samples of solid metal for each color and finish.

G. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

H. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample of each type of coating and substrate required on the Project. Comply with procedures specified in PDCA P5. Duplicate finish of approved prepared samples.

1. The Architect will select one room or surface to represent surfaces and conditions for each type of coating and substrate to be painted. After permanent lighting and other environmental services have been activated, apply coatings in this room or to each surface as specified.

a. After finishes are accepted, the Architect will use the room or surface to evaluate coating systems of a similar nature.

I. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label.

J. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain containers in clean condition, free of foreign materials and residue. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

K. Project Conditions: Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

L. Additional Material: Provide one gallon for each 200 gallons paint used in each color and type (minimum one gallon) to Owner.

1.2 PRODUCTS

A. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers.

C. Colors: Match colors indicated by reference to manufacturer's color designations.

1.3 EXECUTION

A. Examine substrates, areas, and conditions under which painting will be performed for compliance with paint application requirements. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates.

C. Preparation: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

D. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

E. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition.

1. Cementitious Materials: Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation. Use abrasive blast-cleaning methods if recommended by paint manufacturer.

    a. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's written instructions.

2. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.

    a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
    b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and backsides of wood, including cabinets, counters, cases, and paneling.
    c. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.

3. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting Council's (SSPC) recommendations.

   a. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat.

4. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

F. Materials Preparation: Mix and prepare paint materials according to manufacturer's written instructions.

1. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
2. Use only thinners approved by paint manufacturer and only within recommended limits.

G. Application: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Paint colors and finishes shall be selected during construction. Contractor shall allow for use of up to (4) four different wall colors and (2) two different trim colors throughout the building interior, including use of accent walls and use of different colors within the same room/space. Contractor shall allow for use of (2) two different exterior paint colors. Additionally, the contractor may have to color match and paint items to match immediately adjacent pre-finished items and existing items as necessary throughout construction.
2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
3. Provide finish coats that are compatible with primers used.
4. The term "exposed surfaces" includes areas visible when permanent or built-in items are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
6. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
7. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
8. Sand lightly between each succeeding enamel or varnish coat.

H. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has

cured as recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.

2. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
3. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.

I. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

J. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.

K. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

L. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.

M. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

N. Field Quality Control: The Owner reserves the right to engage the services of an independent testing agency to sample the paint material being used. Samples of material delivered to the Project will be taken, identified, sealed, and certified in the presence of the Contractor.

1. The testing agency will perform appropriate tests as required by the Owner.
2. If tests show material being used does not comply with specified requirements, the Contractor shall remove noncomplying paint from the site, pay for testing, and repaint surfaces previously coated with the rejected paint. If necessary, the Contractor may be required to remove rejected paint from previously painted surfaces if, on repainting with specified paint, the 2 coatings are incompatible.

O. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

P. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

Q. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

R. Paint Schedules: Provide the following paint systems for the various substrates indicated by Sherwin Williams (SW), PPG Paints or approved equal products:

S. **Exterior Paint Systems:**

1. Ferrous Metal:

a. Full gloss enamel finish - rust inhibitive primer with acrylic finish

Primer:	SW:	Pro Industrial Pro-Cryl Universal Primer
	PPG:	Pitt-Tech Plus DTM Acrylic Primer 4020
1st Coat:	SW:	Pro Industrial DTM Acrylic Finish, semi-gloss
	PPG:	Pitt-Tech Plus EP Interior/Exterior Acrylic Semi-Gloss DTM Industrial Enamel, 90-1610 Series.
2nd Coat:	SW:	Pro Industrial DTM Acrylic Finish, semi-gloss
	PPG:	Pitt-Tech Plus EP Interior/Exterior Acrylic Semi-Gloss DTM Industrial Enamel, 90-1610 Series.

2. Non-Ferrous Metal:

a. Full gloss enamel finish - galvanized metal primer with acrylic finish (Lintels, Railings, Bollards, etc.)

Primer:	SW:	Pro Industrial Pro-Cryl Universal Primer
	PPG:	Pitt-Tech Plus DTM Acrylic Primer 4020
1st Coat:	SW:	Pro Industrial DTM Acrylic Finish, semi-gloss
	PPG:	Paints Pitt Tech Plus DTM Acrylic Semi-Gloss 4216
2nd Coat:	SW:	Pro Industrial DTM Acrylic Finish, semi-gloss
	PPG:	Paints Pitt Tech Plus DTM Acrylic Semi-Gloss 4216

T. **Interior Paint Systems:**

1. Concrete, Masonry (not including CMU):

a. Acrylic epoxy

Primer:	SW:	Loxon Concrete & Masonry Primer
	PPG:	Paints Speedhide zero Interior Latex Primer 6-4900XI
2nd Coat:	SW:	Pro Industrial Pre-Catalyzed Epoxy
	PPG:	Paints Pitt Glaze W B1 Pre-Catalyzed Epoxy 16-xxx
3rd Coat:	SW:	Pro Industrial Pre-Catalyzed Epoxy
	PPG:	Paints Pitt Glaze WB1 Pre-Catalyzed Epoxy 16-xxx

2. Concrete Masonry Units (CMU): Typical Walls (Block fill prime paint all CMU walls full height and behind all built in casework, lockers, etc.)

   a. Acrylic epoxy – eggshell finish

Filler:	SW:	Loxon Acrylic Block Surfacer
	PPG:	Paints Speedhide Latex Block Filler 6-15XI
2nd coat:	SW:	ProIndustrial Pre-Catalyzed Epoxy, eggshell
	PPG:	Paints Pitt Glaze WB1 Pre-Catalyzed Epoxy 16-310
3rd Coat:	SW:	ProIndustrial Pre-Catalyzed Epoxy, eggshell
	PPG:	Paints Pitt Glaze WB1 Pre-Catalyzed Epoxy 16-310

   b. Acrylic epoxy – semi-gloss finish (Kitchen areas)

Filler:	SW:	Loxon Acrylic Block Surfacer
	PPG:	Paints Speedhide Latex Block Filler 6-15XI
2nd coat:	SW:	Pro Industrial Pre-Catalyzed Epoxy, semi-gloss
	PPG:	Paints Pitt Glaze WB1 Pre-Catalyzed Epoxy 16-510
3rd Coat:	SW:	Pro Industrial Pre-Catalyzed Epoxy, semi-gloss
	PPG:	Paints Pitt Glaze WB1 Pre-Catalyzed Epoxy 16-510

3. Drywall and Plaster:

   a. Acrylic latex

Primer:	SW:	ProMar 200 Zero VOC Interior Latex Primer
	PPG:	Paints Speedhide zero Interior Latex Primer 6-4900XI
2nd Coat:	SW:	Pro Industrial Pre-Catalyzed Waterbased Epoxy
	PPG:	Paints Pitt Glaze WB1 Pre-Catalyzed Epoxy 16-xxx
3rd Coat:	SW:	Pro Industrial Pre-Catalyzed Waterbased Epoxy
	PPG:	Paints Pitt Glaze WB1 Pre-Catalyzed Epoxy 16-xxx

4. Wood:

   a. Acrylic epoxy

Primer:	SW:	Multi-Purpose Interior/Exterior Latex Primer Sealer
	PPG:	Paints Seal Grip Interior Primer/Finish 17-951
2nd Coat:	SW:	ProIndustrial Pre-Catalyzed Epoxy
	PPG:	Paints Pitt Glaze WB1 Pre-Catalyzed Epoxy 16-xxx
3rd Coat:	SW:	ProIndustrial Pre-Catalyzed Epoxy
	PPG:	Paints Pitt Glaze WB1 Pre-Catalyzed Epoxy 16-xxx

   b. Transparent Stain with urethane finish

1st coat:	SW:	Minwax Wood Finish 250 Stain
	PPG:	Deft Interior Low VOC Oil Stain DFT400
2nd Coat:	SW:	Minwax Polycrylic
	PPG:	Deft Waterbased Polyurethane DFT 15x
3rd Coat:	SW:	Minwax Polycrylic
	PPG:	Deft Waterbased Polyurethane DFT 15x

5. Ferrous Metal:

   a. Gloss Finish - rust inhibitive primer with acrylic finish

Primer:	SW:	Pro Industrial Pro-Cryl Universal Primer
	PPG:	Pitt Tech Plus DTM Acrylic Primer 4020
1st Coat:	SW:	Pro Industrial DTM Acrylic Finish, semi-gloss
	PPG:	Pitt-Tech Plus EP Interior/Exterior Acrylic Semi-Gloss DTM Industrial Enamel, 90-1610 Series.
2nd Coat:	SW:	Pro Industrial DTM Acrylic Finish, semi-gloss
	PPG:	Pitt-Tech Plus EP Interior/Exterior Acrylic Semi-Gloss DTM Industrial Enamel, 90-1610 Series.

6. Non-Ferrous Metal (New Galvanized and Aluminum):

Primer:	SW:	ProIndustrial Pro-Cryl Primer
	PPG:	Pitt Tech Plus DTM Acrylic Primer 4020
1st Coat:	SW:	Pro Industrial DTM Acrylic Finish, semi-gloss
	PPG:	Pitt-Tech Plus EP Interior/Exterior Acrylic Semi-Gloss DTM Industrial Enamel, 90-1610 Series.
2nd Coat:	SW:	Pro Industrial DTM Acrylic Finish, semi-gloss
	PPG:	Pitt-Tech Plus EP Interior/Exterior Acrylic Semi-Gloss DTM Industrial Enamel, 90-1610 Series.

7. Concrete Floors – light traffic (janitor closets and utility spaces)

Primer:	SW:	ArmorSeal Tread-Plex Water Based Acrylic Primer
	PPG:	Breakthrough Satin Acrylic V51 Series
2nd coat:	SW:	ArmorSeal Tread Plex Water Based Acrylic Finish
	PPG:	Breakthrough Satin Acrylic V51 Series

8. Concrete Floors – High Traffic Epoxy

Primer:	SW:	ArmorSeal 8100 Urethane Epoxy @ 3.0-5.0 mils dft
	PPG:	Aquapon WB EP Waterborne Epoxy Series 98E @ 2.0 mils dft
2nd coat:	SW:	ArmorSeal 8100 Urethane Epoxy @ 3.0-5.0 mils dft
	PPG:	Aquapon WB EP Waterborne Epoxy Series 98E @ 2.0 mils dft

9. Concrete Floors – Heavy Duty Vehicular Traffic Epoxy (Garages/Apparatus Bays)

Primer:	SW:	ArmorSeal 33 Epoxy Primer @ 8.0 mils dft
	PPG:	PPG Flooring 912 LV (ICO Primer LV) @ 8 mils dft
2nd coat:	SW:	ArmorSeal 1000 HS 2-Part Polyamide Epoxy @ 3.0-5.0 mils dft
	PPG:	PPG Flooring 610 (ICO Guard Coating) – 100% solids epoxy floor coating. Install at one coat – 12-15 mils dft
3rd coat:	SW:	ArmorSeal 1000 HS 2-Part Polyamide Epoxy @ 3.0-5.0 mils dft
	PPG:	3rd coat Not Required
Additive:		Include manufacturer recommended anti-slip additive. Provide samples for selection by Owner, (3) minimum, fine, medium-fine and medium.

10. Exposed Ceiling Deck – Dryfall coating
    Primer – Ferrous Metal:
        SW: Pro Industrial Pro-Cryl Universal Primer
        PPG: Pitt-Tech Plus DTM Acrylic Primer 4020
    Primer – Non-Ferrous Metal:
        SW: Pro Industrial Pro-Cryl Universal Primer
        PPG: Pitt-Tech Plus DTM Acrylic Primer 4020
        Finish 1-2 coats:
        SW: Pro Industrial Waterborne Acrylic Dryfall
        PPG: Speedhide Super Tech Flat Dryfall 6-725XI

END OF SECTION 09900

SECTION 10426 – INTERIOR ROOM SIGNS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Interior Room signage

1.2 SHOP DRAWINGS

A. Submittals

1. Shop Drawings: Provide a shop drawing for the Interior Room Signs. Provide plans, elevations, and sections showing typical members, anchors, layout, reinforcement, accessories, and installation details. Provide the following:

a) A signage spread sheet with each door location, room name, room number and detailed layout.
b) Setting drawings, templates, and directions for installing anchors.
c) Full-size spacing templates for dimensional letters.

2. Samples: Provide a separate physical sample of the color selection material, pattern, and surface texture for each of the signage types listed above in 1.1.A. **All samples go to the Construction Manager or the Owner**.

3. Provide an additional ten (10) Interior Room Signs. The text and format will be provided by the Construction Manager or Owner.

1.3 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 PRODUCTS

A. Basis of Design: VISTA Sign Systems or approved equal

1. Standard Room Sign: Curved Vista Wall Sign 7.87" x 4.1575" x 0.84" with 1mm Glossy/Non-Glare lens with standard ADA tactile and Braille and digitally printed 10 mil double-sided matte rigid PVC film insert

a) V200 (200mm/7.87") aluminum sign holder extrusion, Clear Anodized, 4.1575 inch.
b) CC200 - Clear cover (Glossy/Non-Glare) for V200 extrusion (1mm thick), Glossy/Non-glare, 4 inch.
c) 2 PEC200 - Plastic (ABS) end caps for V200 extrusion, Black.
d) CCADA200 - ADA Lens for V200 extrusion (7.8" / 198mm)

2. Standard Room Sign (Bathrooms, Elevators, Area of Refuge and Room Occupancy) 7.87" x 8" x 0.84" with 1mm Glossy/Non-Glare lens with standard ADA tactile and Braille and digitally printed 10 mil double-sided matte rigid PVC film insert

    a) V200 (200mm/7.87") aluminum sign holder extrusion, Clear Anodized, 8 inch.
    b) CC200 - Clear cover (Glossy/Non-Glare) for V200 extrusion (1mm thick), Glossy/Non-glare, 8 inch.
    c) 2 PEC200 - Plastic (ABS) end caps for V200 extrusion, Black.
    d) CCADA200 - ADA Lens for V200 extrusion (7.8" / 198mm)

B. Fasteners: Concealed noncorrosive metal.

C. Anchors and Inserts: Nonferrous metal or hot-dipped galvanized. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts for concrete or masonry work.

D. Graphic Content and Style: Provide sign copy that complies with size, style, spacing, content, position, material, finishes, and colors of letters, numbers, and other graphic devices. Also include braille lettering to meet the handicapped ADA requirements and 2021 IBC New Jersey Edition Code.

PART 3 EXECUTION

A. General: Install using mounting methods indicated and according to manufacturer's written instructions.

1. Install level, plumb, true to line, and at locations and heights indicated, with surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Signage Used for Room Identification: Install in locations on walls as indicated and according to ADA accessibility standards.

C. Mounting Methods:

1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

    a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.

b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

2. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
3. Brackets: Remove loose debris from substrate surface and install bracket supports in position so that sign is correctly located and aligned.
4. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.
5. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.
6. Shim-Plate Mounting: Provide 1/8-inch- (3-mm-) thick, concealed aluminum shim plates with predrilled and countersunk holes, at locations indicated, and where other direct mounting methods are impractical. Attach plate with fasteners and anchors suitable for secure attachment to substrate.

D. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

E. Remove temporary protective coverings and strippable films as signs are installed.

F. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner

END OF SECTION 10426

SECTION 10800 - TOILET AND BATH ACCESSORIES

1.1 GENERAL

A. Submittals: Manufacturer's product data for each toilet accessory item specified, including details of construction relative to materials, dimensions, gages, profiles, mounting methods, specified options, and finishes.

B. Samples: Full-size samples of the following toilet accessory items to verify design, operation, and finish requirements. Acceptable samples will be returned and may be used in the Work:

1. Stainless steel framed mirror unit.
2. Toilet tissue dispenser (OFCI)
3. Soap Dispenser.(OFCI)
4. Grab Bars.
5. Trash Container.(OFCI)
6. Toilet seat cover dispenser (OFCI)

1.2 PRODUCTS

A. Manufacturers: Subject to compliance with requirements, all items shown in this section are Bobrick Products. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following or approved equal:

1. A & J Washroom Accessories
2. American Specialties, Inc.
3. Bobrick Washroom Equipment, Inc.
4. Bradley Corporation
5. General Accessory Manufacturing Co.
6. McKinney/Parker
7. Kimberly/Clark
8. Georgia Pacific

B. Materials, General: Fabricate toilet accessory items from the following materials and according to requirements specified for individual accessory items:

1. Stainless Steel: AISI Type 302/304, with polished No. 4 finish, 0.034-inch (22-gage) minimum thickness, unless otherwise indicated.
2. Brass: Leaded and unleaded, flat products, ASTM B 19; rods, shapes, forgings, and flat products with finished edges, ASTM B 16; Castings, ASTM B 30.
3. Sheet Steel: Cold-rolled, commercial quality ASTM A 366, 0.04-inch (20-gage) minimum thickness, unless otherwise indicated. Surface preparation and metal pretreatment as required for applied finish.
4. Galvanized Steel Sheet: ASTM A 527, G60.
5. Chromium Plating: Nickel and chromium electro-deposited on base metal, ASTM B 456, Type SC 2.
6. Baked Enamel Finish: Factory-applied, gloss white, baked acrylic enamel coating.
7. Mirror Glass: Tempered Glass Nominal 6.0-mm (0.23-inch) thick, conforming to ASTM C 1036, Type I, Class 1, Quality q2, and with silvering, electro-plated

copper coating, and protective organic coating.

8. Galvanized Steel Mounting Devices: ASTM A 153, hot-dip galvanized after fabrication.
9. Fasteners: Screws, bolts, and other devices of same material as accessory unit, or of galvanized steel where concealed.
10. Keys: Provide universal keys for access to toilet accessory units requiring internal access for servicing, resupply, etc. Provide a minimum of six keys to Owner's representative.

C. Toilet Tissue Dispenser: (OFCI)

D. Waste Receptacle: (OFCI)

E. Trash Container: (OFCI)

F. Surface-Mounted Soap Dispenser: (OFCI)

G. Stainless Steel Grab Bars: Provide grab bars with wall thickness not less than .050 inch (18 gage), Bobrick Model B-6806 or approved equal and as follows:

1. Mounting: Concealed, manufacturer's standard flanges and anchorages.
2. Clearance: 1-1/2-inch clearance between wall surface and inside face of bar.
3. Gripping Surfaces: Smooth, satin finish.
4. Heavy-Duty Size: Outside diameter of 1-1/2 inches.

H. Stainless Steel Channel-Framed Mirror Units: Fabricate frame with channel shapes not less than 0.04 inch (20 gage), with square corners carefully mitered to hairline joints and mechanically interlocked. Provide in Type 430, bright polished finish. Bobrick Model B-165 Series or approved equal.

1. Fabrication: Only a maximum 1-1/2-inch diameter, unobtrusive stamped manufacturer logo, as approved by Architect, is permitted on exposed face of toilet or bath accessory units. On either interior surface not exposed to view or back surface, provide additional identification by means of either a waterproof, printed label or a stamped nameplate, indicating manufacturer's name and product model number.

I. Surface-Mounted Toilet Accessories, General: Except where otherwise indicated, fabricate units with tight seams and concealed anchorage wherever possible.

J. Framed Mirror Units, General: Fabricate frames for tempered glass mirror units to accommodate wood, felt, plastic, or other glass edge protection material. Provide mirror backing and support system that will permit rigid, tamperproof glass installation and prevent moisture accumulation, as follows:

1. Provide galvanized steel backing sheet, not less than 0.034 inch (22 gage) and full mirror size, with non-absorptive filler material. Corrugated cardboard is not an acceptable filler material.

K. Mirror Unit Hangers: Provide system of mounting mirror units that will permit rigid, tamperproof, and theft-proof installation, as follows:

1. Heavy-duty wall brackets of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.

L. Toilet Seat Cover Dispenser: (OFCI)

1.3 EXECUTION

A. Installation: Install toilet accessory units according to manufacturers' printed installation instructions, using fasteners appropriate to substrate as recommended by unit manufacturer. Install units plumb and level, firmly anchored in locations and at heights indicated.

1. Secure mirrors to walls in concealed, tamperproof manner with special hangers, toggle bolts, or screws. Set the units plumb, level, and square at locations indicated, in accordance with manufacturer's instructions for type of substrate involved.
2. Adjust toilet accessories for proper operation and verify that mechanisms function smoothly. Replace damaged or defective items.
3. Clean and polish all exposed surfaces strictly according to manufacturer's recommendations after removing temporary labels and protective coatings.

END OF SECTION 10800

SECTION 15010 – GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 SCOPE

1. The General, Supplementary, and Special Conditions, applicable portions of all divisions and the addenda thereto, are made a part of this Contract.

2. All work described in these specifications shall be the responsibility of the mechanical contractor unless otherwise indicated.

3. It is the intent of these specifications to include all material, service and labor necessary to form a complete and properly operating whole.

4. Where equipment is shown on plans and specified as a single unit in specifications, the equipment quantities shall be per plans. Provide a complete operating system for all equipment.

5. Where reports and/or requirements are specified herein as a single report, it is the intent that each requirement and/or report be separate for each school, i.e., commissioning report, operation instructions, etc.

6. Specifications for certain equipment or performance may not be applicable for all areas. Refer to the plans for where equipment and/or performance are required.

1.02 CONTRACT DRAWINGS

1. Examine all drawings and specifications. Visit the site to become acquainted with the construction and the extent of the work.

2. In referring to drawings, figured dimensions take precedence over scale measurements. Discrepancies must be referred to the Engineer for decision. Each Contractor shall certify and verify all dimensions before ordering material or commencing work.

3. Any work called for in the specifications, but not mentioned or shown on the drawings, or called for on the drawings, but not mentioned in the specifications, shall be furnished as though called for in both. When there is a discrepancy between drawings and specifications, the most considerable shall apply.

4. When any device or part of equipment is herein referred to in singular number, such as "the pump", such reference shall be deemed to apply to as many such devices as required to complete the installation.

5. The term "provide" shall mean "furnish and install". Neither term will be used generally in these specifications but will be assumed. The term "furnish" shall mean to obtain and deliver on the job for installation by other trades and/or this Contractor.

1.03 CODES AND STANDARDS

1. All work shall comply with all regulations and latest edition of applicable codes and be subject to inspection and approval of all authorities having jurisdiction.

2. All electrical work shall comply with latest edition of the NEC National Electrical Code.

3. Where items indicated on contract documents differ from code requirements, contractor shall inform engineer prior to installation. Any construction installed by contractor that is not in compliance with applicable codes, shall be removed, modified, and/or replaced at no additional cost to Owner or others.

4. All equipment shall be labeled by an applicable approved agency.

5. Contractor shall give all notices, obtain and pay for all permits, deposits, and fees necessary.

6. Manufacturer's published data is made a part of these specifications.

7. Wherever a recognized national organization has published standards these shall be complied with (such as ASA Z 21.30 for gas piping).

1.04 SCOPE OF WORK

1. It is the intent of these specifications to include all material, service and labor necessary to form a complete and properly operating whole system.

1.05 PROGRESS

1. See Specification Sections 01040-Coordination, 01310-Construction Progress and 01315-CPM Schedule.

1.06 SHOP DRAWINGS AND SUBMITTALS

1. See Specification Section 01300 – Submittals.

2. Ductwork and piping shop drawings shall be prepared using Auto Cad 2007 or latest edition of Auto Cad @ 1/4" scale (minimum).

3. Equipment Manufacturers are required to provide a written report stating whether or NOT any equipment furnished by the Manufacturer is eligible to receive a Program Incentive payment through the NJ Clean Energy Commercial and Industrial Program (New Jersey SmartStart Buildings®). The report is to be submitted with original shop drawing submittal. Report shall include all supporting equipment specification sheets, applicable AHRI Certificate and any other documentation required.

   Listed below are the types of qualifying equipment & approved technologies listed by New Jersey SmartStart Buildings® that may qualify incentives which require a report be submitted from each equipment manufacturer for each equipment item submitted. (Note: a negative report MUST be submitted where applicable)

   Electric Unitary HVAC
   - Unitary HVAC & Split Systems
   - Packaged Terminal Systems
   - Central DX AC Systems
   - Dual Enthalpy Economizer
   - Controls
   - Occupancy Controlled
   - Thermostats
   - A/C Economizing Controls

1.07 EQUIPMENT DEVIATIONS

1. The material and products mentioned in these specifications are given to establish a standard of quality, design and performance. The phrases "equivalent", "acceptable", "or approved equal" and "equivalent to" shall be used to indicate that other similar products may be used and provided in accordance with "General Conditions", where applicable, such substitutes are accepted by the Architect as meeting all standards necessary to perform the function intended. Specific products listed without reference to equivalents or substitutions shall be provided as specified.

2. Where this Contractor proposes to use equipment other than that specified or detailed on drawings, which will require any changes of the structure, partitions, foundations, piping, wiring or any other part of the design documents; all design, engineering and any new coordination drawings and detailing required by other contractors and/or professionals shall be paid by this Contractor at no additional cost to Owner.

3. Where such deviations from equipment specified and/or indicated on plans, require a different quantity and/or arrangement of any duct work, piping, electrical work, wiring conduit and/or equipment that would have been required for equipment. This Contractor shall with the approval of the Engineer provide all material, equipment and labor required by the change at no additional cost to the Owner.

4. Where such approved deviation requires a change to the structure, electrical, plumbing or any other Contractor's or Sub-Contractor's work, or any change to the construction as indicated on the design documents. This Contractor shall pay for all costs incurred due to such deviations at no additional cost to the Owner.

1.08 REJECTED MATERIALS

1. See Specification Section 01300-Submittals and the AIA Document A201-2017 General Conditions of the Contract for Construction.

1.09 WORKMANSHIP

1. See Specification Section AIA Document A201-2017 General Conditions of the Contract for Construction.

1.10 WARRANTY

1. See Specification Section 01740 – Warranties and Bonds.

2. At the expiration of the 2-year warranty period; provide an additional factory warranty agreement, to include full coverage, parts and labor, plus emergency service for the all new equipment as specified for an additional 3-year period for a total of 5-year warranty period.

1.11 MAINTENANCE SERVICE

1. Contractor shall furnish complete parts and labor service and maintenance of all HVAC systems, equipment, devices, controls, etc., for two (2) years from Date of Substantial Completion as determined by Architect.

2. Provide scheduled maintenance service with three (3) month interval as maximum time period between scheduled service or as indicated elsewhere (applicable only if less than 3-month intervals).

3. Provide 24-hour emergency service on breakdowns and malfunctions.

4. Include maintenance items as outlined in manufacturer's operating and maintenance data.

5. Submit copy of service call work order or report and include description of work performed. Handwritten report acceptable at time of service. Type written report to be provided to Owners' maintenance staff within two (2) weeks of service call.

6. See Section 15930 for additional requirements for control system.

1.12 AS-BUILT DRAWINGS

1. See Specification Section 01700 – Project Closeout

1.13 FIRE RATING

1. All materials used anywhere in the work must have NFPA rating, and be in accordance with ASTM-E-84 as follows:

   A. Flame Spread - Not Over 25
   B. Smoke Developed - Not Over 50
   C. Fuel Contributed - Not Over 25

2. All materials shall be "Self-Extinguishing".

1.14 EQUIPMENT SELECTION AND SERVICEABILITY

1. All equipment shall be located and installed so that it may be serviced. Demonstrate to Owner as part of instructions that there is room to remove all coils, tube bundles, filters, motor and similar equipment. Equipment which is too large or poorly located to permit servicing shall be replaced or repositioned or modifications made to allow for proper servicing at no additional cost to the Owner.

2. Where piping, control diagrams and/or sequencing differ from the recommended piping arrangements of the equipment manufacturer, and will directly affect the equipment performance, the manufacturer's recommendations shall be submitted in writing to the Architect/Engineer for approval, prior to purchasing the equipment involved and piping arrangement, control, etc., as recommended by manufacturer shall be used. This Contractor shall be responsible for obtaining such recommendations from the manufacturers in order to effect correct and proper operation of the equipment at the capacities and temperatures indicated.

1.15 EQUIPMENT FURNISHED BY OTHER TRADES

1. All equipment furnished and/or installed by other trades requiring connections and services by this Contractor shall have such services provided by this Contractor.

2. This Contractor shall verify exact requirements with approved shop drawings supplied by the equipment contractor and/or supplier prior to construction.

3. This Contractor shall verify locations, sizes and requirements of all services to equipment, in field with the equipment contractor prior to construction.

1.16 FACTORY TESTING

1. All factory assembled packaged equipment shall be factory tested including helium leak testing of the coils, pressure testing of the refrigeration circuit, and run testing of the completed unit. A certified factory Run test report shall be provided for each unit. **The "Run Test Report" shall be submitted to Owner for approval, prior to acceptance of unit for payment.**

2. All factory assembled packaged equipment shall be fully quality tested by factory run testing under normal operating conditions. Quality control system shall automatically perform via computer; triple leak check, pressure tests, evacuation and accurately charge system, perform detailed heating and cooling mode tests, and quality cross check all operational and test conditions to pass/fail criteria.

3. Detailed report card will ship with each unit displaying status for critical tests and components.

4. If unit fails on any cross check, it shall not be allowed to ship. Serial numbers will be recorded by factory and furnished to contractor on report card for east of unit warranty status.

1.16 EQUIPMENT TO BE **FURNISHED BY OWNER**

1. All equipment which shall be furnished by the Owner will be identified throughout the plans and specifications as "**FURNISHED BY OWNER**".

2. The equipment **FURNISHED BY OWNER** is the equipment located in the HVAC shop that is used for instructional purposes only. All HVAC equipment associated with the building systems shall be furnished and installed by contractor.

3. The equipment **FURNISHED BY OWNER** is equipment that is to be used for instructional purposes. The equipment shall be installed with all appurtenances for an operating system.

4. The ancillary equipment and materials (refrigerant pipe, intake and exhaust fan furnaces, etc.) shall be installed to allow for the equipment to be operated. Further, wherever possible, the ancillary systems shall be installed so that it may be easily disassembled and assembled in the future as part of the circulation.

5. The Owner shall be responsible for furnishing the following:

   - Purchasing the Specified Equipment and/or Contractor Services indicated on plans and specifications as "**FURNISHED BY OWNER**". Refer to plans and specifications for **FURNISHED BY OWNER** equipment submittals submitted by the Equipment Manufacturers. Refer to plans and specifications for additional **FURNISHED BY OWNER** scope of work provided by the design team as required to provide further clarity or provide corrections due to omissions or errors by the Equipment Manufacturer's submittals.

6. For equipment **FURNISHED BY OWNER**, this CONTRACTOR shall be responsible (in all

aspects) for providing the following. The following list is a guide and reference exclusion of any item does not relieve contractor from providing a fully functional and operational system. Commissioning, balancing and installation per specifications.

- Reviewing & coordinating shipping status once the equipment is ordered
- Receiving, unloading, storing and inspecting the equipment.
- Coordinating all aspects of the equipment delivery with the trucker.
- Accepting, safeguarding and secure storage any accessory shipped separately from the main unit.
- Provide all Receiving and unloading of all material.
- Provide All Rigging and permits.
- Inspect all material upon arrival.
- Coordinating, filing, and processing of any damage claims with the responsible shipping and delivery vendor.
- Before installation of equipment, verify that the unit has the proper voltage, gas connections and model numbers.
- Provide secured storage required with protection from weather, vandalism, and any other potentially damaging conditions.
- Review equipment for compliance with plans and specifications
- Reviewing and complying with all manufacturer's recommendations
- Coordinating all aspects of equipment's' installation, including but not limited to: layout, code compliance, roof penetrations, electrical requirements and protection from weather.
- This Contractor is responsible for all installation of all equipment and accessories furnished by Owner and/or by this Contractor.
- Furnish and install all specified Ductwork as indicated on plans and specifications.
- Furnish and install all specified all Gas Piping and Specialties (booster, regulator, etc.) as indicated on plans and specifications.
- Provide Cleaning of equipment.
- Provision of all Balancing and Belt/Sheave Changes required for balancing.
- Provide all specified Commissioning of equipment installed by this Contractor.
- Provide all other pertinent services required for proper operation of the above specified equipment installed by this contractor.
- Provide Testing and Balancing (TAB), required for Balancing of the above specified equipment installed by this contractor.
- This Contractor shall verify locations, sizes and requirements of all services to equipment, in field with the Owner prior to construction.

PART 2 PRODUCTS

2.01 ELECTRICAL EQUIPMENT

1. This Contractor shall furnish all his equipment complete with motor, controllers, capacitors and starting equipment.

2. Electric motors shall be premium high efficiency (refer to table below for minimum efficiency), open, drip proof induction motors premium high efficiency rated for continuous duty at 15% overload with 40° C. rise; single phase motor shall be capacitor start-induction run. Motors one-half and larger shall be polyphase, motors smaller than one-half horsepower shall be single phase, unless otherwise noted (see Division 16). Starting equipment shall consist of magnetic

across-the line starters by Furnas Bulletin 14 or approved equal, unless otherwise specified. Thermal overload type, motor rated manual switches shall be furnished for motors ¾ HP and less which do not require magnetic starters for control purposes.
Premium high efficiency motors shall have efficiencies equivalent to or greater than listed below.

SIZE/HP	1800 RPM ODP NEMA NOMINAL EFFICIENCY	1800 RPM TEFC NEMA NOMINAL EFFICIENCY
1	85.5%	85.5%
1.5	86.5%	86.5%
2	86.5%	86.5%
3	89.5%	89.5%
5	89.5%	89.5%

3. Provide FPE/CDE Type 1C Power Factor correction capacitors size to increase full load power factor to 95%. Capacitors shall be fused, in NEMA enclosure, connected between safety switch and motor starter.

4. Where apparatus is specified as "Packaged", all electrical equipment shall be furnished, set and wired to a single point of connection for apparatus as a unit.

5. This Contractor shall set all electrical equipment furnished by this Contractor unless same is to be mounted on an electrical panelboard, junction box or similar piece of electrical equipment and is to be wired by others.

6. Where electrical characteristics are not shown, all electrical characteristics shall be as indicated on electrical plans. Where there is a conflict between model numbers which indicate electrical characteristics and electrical drawings, the electrical drawings shall take precedent.

7. This Contractor shall verify all electrical characteristics of all equipment with the electrical contractor. This Contractor shall submit to Electrical Contractor location of all motors, starters, all other electrical equipment, voltage and phase required prior to submission of this Contractor's and/or electrical contractor's shop drawings or start of construction. This Contractor shall submit to the electrical contractor all equipment requiring electrical services and obtain the review of the shop drawings for correct electrical characteristics for the electrical contractor prior to submission for review.

8. Should this Contractor change type of equipment which results in change to electrical characteristics, then this Contractor will be responsible to coordinate these changes with all other trades and pay for all costs required as a result of changes.

9. Should this Contractor change electrical characteristics of equipment from that shown on electrical drawings or does not submit shop drawings to the electrical contractor for his review, he is responsible for all cost required, resulting from such change or failure to submit shop drawings.

2.02 ELECTRICAL WIRING

1. This Contractor shall furnish and install all electric power wiring required for his contract, with the exception of certain wiring shown under electrical contract. This Contractor shall furnish and

install all control wiring required for his contract including power wiring to all ATC devices, panels, etc. (unless indicated otherwise on electrical plans).

2.

2.03 RELIEF VALVES

1. Provide ASME or approved equal labeled relief valve on each closed fluid system, set to relieve full code capacity at design pressure. Pipe discharge to suitable receptor with air gap in accordance with all codes. Do not locate pipe at floor to create a tripping hazard.

2.04 GAUGE GLASSES

1. Jerguson #56 or approved equal cocks with bleed fitting and vertical rising ball check for tubular glass with four guard rods.

2.05 PRESSURE GAUGES

1. All pressure gauges shall be Ashcroft 1020 or approved equal, 4½ size with white dial, black figures and markings. Gauges shall be provided with level handle gauge cock and steam siphon where required.

2.06 THERMOMETERS

1. Thermometers shall be 5" diameter dial type with stainless steel cases and separate wells. Ashcroft T-7173T or approved equal, adjustable to any angle.

2.07 TAGS

1. This Contractor shall provide a 2" dia. brass tag with stamped service designation and valve numbers, fastened to each valve with brass chain and "S" hook.

2. Each control, starter, disconnect switch, etc., shall be provided with 3/4" x 2-1/2" metal name tag securely fastened to device. Name tags on controls exposed in finished spaces shall be located on the inside of access door or access panel. Provide valve chart and schematic diagram along with floor plan. Both chart and diagram shall be permanently mounted with metal frame and glass front in mechanical room or other area designated by Owner. This Contractor may submit an alternative mounting method for Owners' review and approval.

2.08 EQUIPMENT ISOLATION

1. Provide shutoff valves on supply and balancing and shutoff valve on return lines for each piece of equipment including all radiation loops, unit heaters, coils, air handling units, fan coil units and all pieces of hydronic equipment.

2. At all branch lines serving two or more pieces of equipment, provide a shutoff valve on supply and balancing and shutoff valve on return at the points where the branch line connects to main. Provide drainage and slope pipe to drain points.

3. At all branch lines from mains, whether directly feeding equipment or not, provide shutoff valves on supply and return with ability to drain branch lines.

4. All valves shall be tagged (see tags) and when installed above accessible construction, provide

color coded markers (per architect's direction). Where installed above non-accessible construction, contractor shall provide access panels. Panels shall be marked for equipment.

2.09 EQUIPMENT IDENTIFICATION

1. All HVAC equipment, control panels and starters shall have engraved plastic equipment tags. Tags shall be 1/16" plastic with mounting holes or adhesive backing to allow tags to be permanently mounted to equipment. Indication shall be for the equipment number, usage and location and where applicable circuit numbers and panel for electrical feed served. Equipment number shall be per the contract documents, or where different numbering system is used by the contractor, the number system shall be per as-builts, O & M manuals and/or control drawings. Areas served shall be per room name and number (if applicable) based on architectural plans; contractor to verify prior to submittal. If different room designations and number system is used by Owner/contractor, these shall be used.

2. Size of equipment tags shall be minimum 1"x3". Larger sizes shall be used, 1-1/2" x 4", for equipment requiring additional information.

3. Colors shall be to the extent practical and possible, match duct and pipe marker color.

4. For equipment not ducted or piped, provide same color as adjacent equipment. Engraved plastic equipment tags shall be manufactured by MSI or approved equal.

5. Equipment location tags shall be used for equipment located above acoustical ceiling. Provide white permanent adhesive one inch long by half inch-wide labels on the ceiling grid with color coded laser printed text to identify all above ceiling devise, equipment and valves.

PART 3 EXECUTION

3.01 METHOD OF PROCEDURE

1. The drawings accompanying these specifications are diagrammatic and intended to cover the approximate and relative locations of the systems. Where FMCS plenum-rated cable wiring is allowed it shall be run parallel to or at right angles to the structure, properly supported and installed in a neat and workmanlike manner.

2. Installation, connection and interconnection of all components of these systems shall be complete and made in accordance with the manufacturers' instructions and best trade practices. This Contractor shall erect all parts of equipment to be furnished by him under his contract in such time and in such a manner as not to delay or interfere with other contractors' work.

3. This Contractor shall lay out his work and be responsible for the establishment of heights, grades, etc., for all interior and exterior piping, equipment, conduit, duct work, etc., included in Contract Documents, in strict accordance with the intent expressed thereby. The establishment of the location of all work shall be performed in consideration of the finished work. In case of conflict, equipment and/or materials shall be relocated without additional cost to the Owner, as directed by the Architect, regardless of which equipment was installed first.

4. Each contractor shall cooperate with other contractors for the proper securing and anchoring of all work included within these specifications. Extraordinary care shall be used in the erection and installation of all equipment and materials to avoid marring surfaces of the work of other

contractors, as each contractor will be held financially responsible for all such damage caused by the lack of precaution and due to negligence on the part of his workmen.

5. Do not run pipe or conduit for mechanical systems in any concrete slab 3" or less in thickness. Do not place any pipe or conduit in any slab where the outside diameter of the pipe or conduit is more than one-quarter the thickness of the slab.

6. All piping, duct work, conduit and other mechanical materials and equipment shown to be mounted below ceilings are to be kept as close to ceiling areas as possible unless otherwise noted.

7. All items such as valves, dampers, equipment, controllers, starters, ATC panels, etc., that will be concealed in construction shall be installed and so arranged as to be fully accessible for adjustment, service and maintenance by use of access doors.

8. Where these devices are above suspended ceiling, colored indications mounted on ceiling, markings on suspended ceiling grid, shall be submitted for review and be used to indicate such devices. Color scheme and material used for this shall be coordinated and approved by Owner and reviewed by engineer.

3.02 CLEANING

1. Upon completion of the work, this Contractor shall remove all excess material, debris, tools and equipment from the site, and leave the premises in a broom clean condition.

2. Flush out all piping systems with proper solvents to insure removal of all foreign materials. Clean equipment, piping and other surfaces soiled by the work. Remove debris and rubbish on a daily basis.

3. Disposal of all materials shall be this Contractors' responsibility. All solvents and other chemicals, and materials used, shall be disposed of in strict accordance with all applicable environmental codes.

3.03 START-UP AND ADJUSTMENTS

This work is the contractors' responsibility is not part of commissioning and is to be done prior to commissioning.

1. Equipment Start-UP

   A. This Contractor shall provide all start-up. Start-up shall be provided by the equipment supplier for all equipment.

   B. As part of start-up, the equipment manufacturer shall provide a complete checklist of all start-up requirements for each piece of equipment. This checklist, when completed, shall be provided to the architect/owner indicating that the equipment has been started up, adjusted, balanced, tested and installed in strict accordance with the equipment manufacturer's requirements and is functioning per specification.

C. This written confirmation shall be the equipment manufacturers' standard checklist for start-up. All start-up, adjustments, replacement of equipment, rebalancing, installation, and any other modification to the equipment or system required to provide the correct and/or specified performance shall be made at no additional cost to Owner. Any of the above items needed shall be indicated as part of this start-up.

D. All start-up provided by the equipment manufacturer shall have written confirmation as specified above and shall be submitted to Owner/architect prior to contractor submission of payment for substantial completion. Failure to provide start-up reports will result in non-payment of billing for substantial completion.

E. Where any modifications and/or reinstallation is required as specified above and results in additional work to any other contractors or subcontractors work, this work shall be the responsibility of the HVAC contractor and shall be done at no additional cost to Owner/Architect.

F. Where start-up is not completed in a timely manner and results in additional cost to other contractors, regardless of cause, these additional costs will be the responsibility of the HVAC contractor. These costs shall result in no additional cost to Owner.

G. The equipment manufacturer personnel who will do the start-up and provide report shall be a certified factory trained representative whose primary function is starting up of equipment. Qualifications of the start-up representative shall be provided as part of the report or inspection.

H. As part of start-up, the Owner shall be provided operation and maintenance manuals.

I. As part of start-up and/or inspection services after start-up has been performed, the same factory trained representative shall be available for a period of classroom instruction to instruct the Owners' personnel in the proper maintenance equipment.

J. This Contractor shall supply the Owner with the following literature as furnished by the manufacturer, four weeks prior to start-up, and have equipment manufacturer representative available for any questions.
- Three (3) complete sets of installation drawings.
- Field wiring diagrams.
- Installation instructions.
- Start-up operation and maintenance instructions.

K. It is the intent of these specifications that the factory start-up personnel have their expertise in the equipment that they are providing start-up service. Where one manufacturer provides more than one type of equipment (i.e., chiller rooftops, etc.), then a factory trained representative for each different type of equipment, if necessary, shall provide start-up, inspection report and/or training.

L. Where start-up results in performance which is not in accordance with contract documents or manufacturers' specifications, this Contractor shall submit to the architect the discrepancies prior to commissioning of work. Any discrepancies shall be the responsibility of the HVAC contractor and be corrected by this Contractor at no additional cost to Owner.

M. **All of the work in this section must be completed and accepted by the Owner/Architect as a condition for issuing a substantial completion letter.**

2. Upon completion of initial testing and prior to final balance, this Contractor, ATC subcontractor and sheet metal sub-contractor shall perform a survey and testing of the entire system. The testing shall be done with the commissioning agent and/or Owner. Contractor shall include the services of a minimum of three (3) personnel; not to include control personnel and equipment start-up personnel. This report is in addition to and to be completed prior to commissioning. Balance for substantial completion will be withheld until report is completed, reviewed and accepted.

3. As a result of test, adjustments, and work necessary to perform the above, this Contractor shall, at his own expense, remove and replace any construction, either his or of other contractors. It is incumbent upon this Contractor to schedule the required work so as to not affect other trades or progress of other contractors' work.

3.04 OPERATING AND MAINTENANCE INSTRUCTIONS

1. This Contractor shall prepare complete sets of bound operating and maintenance instructions for school; including valve chart framed under glass or laminated with clear plastic mounted on masonite board, indicating number, location and purpose of each valve. Two (2) charts and one (1) mylar copy shall be provided for each mechanical room or as designated. The instructions prepared shall be black on white and shall be complete enough so that men generally familiar with the type of system will need no further data to properly perform the indicated procedures.

2. This Contractor shall furnish qualified personnel to instruct the Owner's people in the operation of the system and must request from the Owner, in writing, a date for such instruction to begin. Contractor's personnel shall remain until such instruction is complete to Owner's satisfaction. This Contractor shall receive from Owner written verification that the Owner's personnel have been thoroughly instructed in the operation, maintenance, and all facets of the system operation. Where instructions and operation for a particular system cannot be properly done due to system not being able to be operated, i.e., cooling system in winter; this Contractor shall obtain from Owner time and date when this instruction will be performed and provide instructions at that time and date when system can be properly operated. This shall be done at no additional cost to Owner and final payment to contractor shall reflect this requirement.

3. This Contractor shall provide to engineer for approval report indicating the itinerary of this instruction complete with duration of instructions location, time, and all other pertinent data.

4. This Contractor shall have manufacturers' representatives, as part of their start-up, provide instruction on each piece of equipment. Where offsite instruction, due to complexity of systems, is required as determined by engineer of record, this shall be provided at no additional cost.

5. Manuals shall include all equipment, equipment parts lists, complete oiling, recommend spare parts, complete coiling, cleaning and servicing data compiled in a clearly indexed and easily understood form. The data shall indicate the serial numbers of each piece of equipment and provide complete lists of replacement parts, motor parts, ratings and actual loads.

6. Provide list of any special emergency operating instructions and a list of service organizations (including addresses and telephone numbers) capable of rendering emergency service to the various parts of the system.

7. Provide a certified log of air quantities at all air supply, return and exhaust openings, ASME and State pressure vessel inspection forms, all motor data, including standard and actual operating in service data and copies of all manufacturer's equipment guarantees and warranties.

8. Provide all ASME and State pressure vessel inspection forms.

9. Provide list of all motor data, including standard and actual operating in service data.

10. Provide all manufacturer's equipment guarantees and warranties.

11. Provide a list of units, filter sizes, quantities and recommended changes. For each piece of equipment, locate filter and demonstrate filter change.

3.05 TRAINING AND INSTRUCTION

1. Provide operating instructions shall include wiring and control diagrams showing complete lay out of each system. These instruction periods shall be a minimum of:

   General System - 20 Hours
   Filter Changing – 8 Hours

   Provide additional training for equipment (see specification sections for hours) as specified in equipment specification sections and control system (see Specification Section 15930). The requirements for these instructions are in addition to the startup requirements for each type of equipment per Specification Section 15010, Part 3.03.

3.06 PAINTING AND FINISHING

1. All painting is to be done in accordance with Rust-Oleum Corporations or approved equal printed instructions. All surfaces to receive two (2) coats of primer, exposed surfaces one (1) finished coat, color selected. Aluminum or galvanized metal surfaces are considered finished where concealed.

2. All surfaces to be carefully cleaned and/or pickled and filled as required to provide a proper uniform surface. Factory finished equipment shall be touched up or refinished where required.

3. Where equipment is provided as factory painted and is visible on roofs from grade (as determined by construction manager), exposed in space or otherwise not concealed behind finished surfaces, equipment shall be factory painted in accordance with manufacturers standard painting procedures. The color shall be selected by architect and a color chart shall be submitted for review.

4. All duct exposed and all other exposed equipment, pipe and appurtenances in all other areas unless specifically indicated to be painted by general contractor, to be painted by this Contractor color as selected. Submit for approval. All surfaces shall be prepared for painting and/or constructed of materials suitable to be painted.

5. All tags, labels and other removable instructions not required by manufacturer to remain on equipment shall be removed.

6. Remove all labels and tags on sheet metal for exposed duct and duct above ceiling.

3.07 CONSTRUCTION SAFETY

1. All work shall be done in accordance with the following Federal regulations:

   A. Williams-Steiger Occupational Safety and Health Standards, Chapter XVII of Title 29, Codes of Federal Regulations.

2. Comply with local Health and Safety Regulations.

3.08 ENERGY CONSERVATION CODES

1. It is the intent of this specification that all equipment and materials furnished meet the latest enforced edition of the International Energy Conservation Code, latest applicable edition; or such code as locally applicable, if more restrictive.

3.09 FLASHINGS

1. All piping passing through roofs shall be provided with Stoneman "Stormtite" or approved equal seamless lead flashing.

2. All ducts penetrating roof shall be provided with curbs, flashing, counterflashing and flashing collar welded to duct. Coordinate exact requirements with roofing contractor or roof bonding agent.

3.10 EQUIPMENT INSTALLATION

1. Rooftop equipment installed within 10' of edge of roof shall have a painted guard, provided by this Contractor, at edge of roof, top of guard to be minimum 42" above roof surface, constructed to prevent passage of 2" diameter sphere.
2. Mounting, details, color, and arrangement of guard shall be submitted for review. Coordinate all details with all other contractors.

3.11 EQUIPMENT LIST

Refer to general conditions. Exclusion of items on list does not relieve Contractor of the responsibility of providing equipment as specified, required to complete work or shown on drawings to be provided by this Contractor.

	MANUFACTURERS			
EQUIPMENT	NUMBER 1	NUMBER 2	NUMBER 3	NUMBER 4
Exhaust Fans	Cook	Greenheck	Pennvent	Or approved equal
Air Devices	Metal Aire	Tuttle Bailey	Anemostat	Or approved equal
Valves	Mueller	Stockham	Nebco	Or approved equal
Vibration Isolation	Mason Industries	Vibration Mountings		Or approved equal
Insulation	Owens Corning	John Manville	Knauf	Or approved equal
Air Vents	B & G	Sarco	Taco	Or approved equal
Louvers	Air Balance	Penn Vent	Portnoff	Or approved equal
Strainers	Sarco	Mueller		Or approved equal
Hot Water Specialties	B & G	TACO	Thrush	Or approved equal
Rooftop Units	Carrier	Daiken	Johnston	Or approved equal

3.12 SCHEDULE OF WORK AND COMPLETION DATES

1. The exact times and dates and schedules that the projects will be available for this Contractor to do work, shall be as indicated in General Conditions. Refer to general conditions for completion dates.

3.13 DELIVERY AND STORAGE OF EQUIPMENT

1. This Contractor shall store, take deliveries and install all equipment in accordance with manufacturers' requirements (see "General Conditions").

3.14 ALTERNATE BIDS

1. See the Bid Form – Part B - Alternates for all of the alternate bids. See plans and specification for extent of work.

3.15 CONSTRUCTION SEQUENCING

1. Refer to General Conditions for the overall contract staging. However, specific items for the contractor should be noted. The following are suggested methods of staging of construction. Alternate methods to achieve the intent of these specifications will be allowed; however, they must be coordinated with other trades and submitted for review and approval.

2. The sequence of construction shall be as indicated in the General Conditions of the specifications.

3. Where work is shown on mechanical plans where it is outside the phase areas indicated or specified in the General Conditions, this work shall be done at any time. All work shall be done so not to interfere with normal school operations. Where work is done outside normal school occupied areas (boiler room, roof area), this work may proceed at contractor's option. All work, regardless of the location of work, type of work, or extent of work, shall be done with the approval of the School District.

4. Where work in a particular phase requires work to be done outside that phases' construction boundaries, this Contractor shall locate all new duct, pipe, and equipment to allow for new construction and/or to integrate with existing building construction.

5. Where ductwork is to be installed in an unconditioned space (due to space not being constructed when duct, pipe, etc., is required to be installed), the pipe and/or duct shall be insulated as specified for outdoors. Where new pipe is required to be installed in an unconditioned space or space which shall be exposed to freezing, the pipe shall be insulated as specified for outdoors and heat traced to prevent freezing (power wiring by this Contractor).

6. All new ductwork and piping shall be installed and coordinated with proposed new work.

7. All work required to be modified due to non-compliance with this section, General Conditions or Construction Sequencing, shall be removed, replaced and/or modified at no additional cost to Owner.

8. The permanent ATC system shall be operational for any new construction, regardless of phase. Existing and/or new DDC systems and all wiring shall be installed and protected during

construction to facilitate phasing. The use of modular control panels (LSIS, SAC's, etc.) will be allowed as long as the system functions can be monitored and controlled from that location for that phase and be connected to main system upon completion of work. Owner to be instructed on operation (not part of instruction period).

3.16 ALLOWANCE

1. See Specification Section 15010 and 01210 - Allowances.

3.17 RELOCATION OF EXISTING EQUIPMENT

1. This Contractor shall be responsible for removal, storage, relocation and installation of all existing equipment shown or scheduled to be relocated or as may be required to remove existing equipment and/or install new equipment. This Contractor will be responsible for capping and reconnection of all existing services presently feeding existing equipment which must be relocated and/or modified and shall patch all adjacent surfaces to match existing.

3.18 PROTECTION OF SERVICES DURING CONSTRUCTION AND DEMOLITION

1. This Contractor shall repair, replace, and maintain in service any utilities, facilities or services (in existing areas where new work and/or demolition is to occur) which are damaged, broken, or otherwise rendered inoperative during the course of demolition and/or construction.

2. This Contractor shall effectively protect, at his own expense, his work, materials and/or equipment which may cause injury to building personnel during the construction period. All openings must be securely covered, or otherwise protected.

3. This Contractor shall be held responsible for all damage so done until his work is fully completed and finally accepted.

4. It shall be the responsibility of this Contractor to protect all existing construction and new motors, HVAC equipment, pumps, electrical equipment, plumbing fixtures and all construction during all phases of construction.

3.19 CUTTING AND PATCHING

1. Unless otherwise specified and/or shown on architectural, HVAC and/or structural plans and specifications, to be done by general contractor, this Contractor shall cut and patch walls, floors, ceilings, roof surfaces and all existing construction for the removal of existing equipment, fixture, piping, controls and other construction for the completion of work under this Contract. All equipment, piping, ductwork, furniture and all construction or materials that are disturbed during construction shall be stored and protected from damage until replaced.

2. Cutting shall be done only after shop drawings have been prepared and with the Architect's approval. This Contractor shall exercise proper care and shall not endanger the structure by indiscriminate cutting and shall be responsible for and shall protect all existing construction to remain from damage. Provide and maintain all necessary temporary protective materials, coverings and barricades.

3. This Contractor may hire the other prime contractors to perform this work or hire a pre-qualified, independent contractor. This Contractor shall be familiar with and assume all

responsibility for any conflicts with union policy and provide supervision in such a manner as not to impede the progress of other trades and be responsible for the adequacy and accuracy of same.

4. Wherever previously unfinished areas are exposed by the removal of existing equipment, these areas shall receive new finishes to blend into the adjoining work.

5. Wherever existing chases must be enlarged to encase new work, they shall be enlarged to match the existing construction.

6. Wherever fire rated material must be patched, it shall be patched in a manner not to affect its fire rating.

7. All patching work must be done by skilled mechanics in a manner to minimize the patch effect. Wherever new painting is required, it shall be done with at least two coats over new materials.

8. The painting must not only cover the area of the actual patch, but also to the nearest natural break of the newly painted surface. Wherever the surrounding surface to be painted is in poor condition, all loose paint shall be removed before new paint is applied.

9. Patching of existing floor must be done in a manner to assure smooth undersurface and all joints must line up with existing.

10. Wherever new vinyl or rubber bases are to be supplied, they shall match adjoining bases in height and color.

11. Whenever existing ceilings are disturbed, they shall be replaced with new ceiling tiles or patched to match existing and all services, lights, fixtures, etc. supported temporarily and permanently reinstalled.

12. This Contractor shall remove and replace all ceilings required for his work with the exception of ceilings shown to be removed by general contractor on architectural plans.

3.20 NEW ROOF OPENINGS IN EXISTING ROOFS

1. Unless otherwise shown on plans, the general contractor shall cut all new openings in roof. Structural work by steel contractor or general contractor. General contractor to provide flashing and counterflashing for openings. This Contractor shall provide all curbs and equipment. Structural steel must be installed prior to cutting holes.

2. HVAC contractor shall verify opening locations by use of coordination drawing developed by this Contractor. Prior to any cutting or construction, this Contractor shall physically mark locations for all other prime contractors.

3. Once hole is cut by the general contractor, prior to duct or equipment being set, this Contractor shall temporarily protect the opening. After duct and/or curb or equipment is permanently installed by HVAC and flashed and counterflashed by general contractor, and opening is weatherproofed, it shall be the responsibility of the general contractor for any water damage.

4. As part of the coordination, the HVAC, structural and general contractors shall provide a schedule agreed to by all parties so that the new openings are permanently closed as soon

possible. No opening shall be left temporarily sealed for an extended period of time, as determined by the construction manager.

3.21 REMOVAL

1. This Contractor shall remove existing systems as indicated on drawings.

2. All equipment, cabinets, ductwork, pipe controls, all pipe insulation (except any asbestos insulation), hangers, electric wiring and all construction and appurtenances shall be removed, to complete all work under this Contract. All work by this Contractor.

3. Equipment identified by Owner, prior to removal, that is to be retained by the Owner, which is not to be re-installed, and is to remain the property of the Owner shall be removed undamaged and stored in the building. Location shall be determined by the construction manager at no additional cost to Owner. This Contractor shall then load, transport and unload equipment from building to a site designated by Owner within 20-mile radius of site.

4. Removed ductwork, registers, equipment, automatic controls, pneumatic tubing, piping, pipe insulation and electric wiring and all debris shall be removed from the building and site in accordance with general conditions and shall be disposed of in accordance with all applicable environmental rules and regulations. Failure to properly dispose of materials in a proper manner that result in fines, penalties or additional cost are the responsibility of this Contractor.

5. All debris in areas occupied by the building personnel during periods of building operation shall be removed daily.

6. This Contractor shall patch all wall, floors and ceilings and roof surfaces to match existing adjacent surfaces where obsolete equipment, piping, ductwork, controls and wiring are removed.

7. Work shown on drawings may not indicate all equipment, pipe, etc., nor exact routes, sizes, locations, etc. The drawings are not to be used for estimating detailed take-off for amount of work required, drawings are for reference only. This Contractor shall visit site to determine extent of work and all conditions.

8. Where existing louvers are shown to be removed, the HVAC contractor shall remove and provide temporary closure and general contractor to provide permanent construction unless otherwise specifically indicated.

3.22 BUILDING ALTERATION WORK

1. This Contractor shall furnish all labor, equipment and materials required to complete alteration work in the building. Unless otherwise indicated on architectural drawings, this Contractor shall remove existing construction and replace, to remove existing equipment and/or install new equipment in conjunction with the work.

2. Cut, patch and paint walls, floors, ceilings, roof surfaces and all construction for the installation of equipment, piping and controls.

3. Cut and patch exterior walls for the installation of air intake and exhaust. Finish to match existing adjacent surfaces.

4. Where existing electrical HVAC or plumbing work, due to removal of existing and/or installation of new equipment, is required to be removed. This Contractor shall disconnect existing equipment, cap services in a safe manner, remove equipment, store in a location to prevent damage, replace equipment, patch construction to match existing conditions and reconnect equipment to existing services.

5. This Contractor shall either retain qualified independent contractors or utilize the other on-site contractors. This Contractor shall assume all requirements for any conflicts with union policy and be responsible for same. This Contractor shall furnish necessary shop drawings and supervision, in such a manner as not to impede the progress of other trades and be responsible for the adequacy and accuracy of same.

3.23 FLUSHING OF EXISTING SYSTEM

1. Refer to Specification Section 15720 for details.

2. This Contractor shall flush the entire schools' hot water heating system. Flush chilled water system and condenser water.

3. In addition to the work specified, there shall be provisions to install additional new automatic air vents on existing system.

4. These shall be installed where contractor has determined that the existing air venting system will not allow for proper bleeding of the existing system after flushing.

5. The contractor shall refer to unit price schedule for additional air vents or for air vents not used.

END OF SECTION
15010.6290

SECTION 15110 - BASIC MATERIALS AND METHODS

PART 1 GENERAL

1.01 MATERIALS AND EQUIPMENT

1. All material and equipment used for this contract shall be unused and of the latest model or design available. Equipment shall be installed in strict accordance with manufacturer's recommendations and details.

2. Materials not specifically described but indicated or incidentally required shall be acceptable to the Architect and/or Engineer. Submit shop drawings. Materials shall be delivered, stored and handled so as to preclude injury by weather, dirt or abrasion.

3. This Contractor shall use only specifically assigned areas for storage of materials and construction operation, unless other areas are authorized by the Owner. Such areas will be identified after the award of Contract by Owner. Comply with local municipal regulations regarding use of and parking on public streets.

4. This Contractor shall repair streets, drives, curbs, sidewalks and any existing surface where disturbed by construction operations and leave them in as good condition after completion of the work as before operations started.

1.02 PROTECTION

1. No pipe shall be left open any longer than is required to affix the next piece. If pipe ends are to be left for an extended period, they shall be closed with approved plugs or caps.

2. All equipment shall be covered to protect it from damage; all damage is the responsibility of this Contractor.

3. Any pipe, equipment or construction in existing building shall be done in such a manner to prevent injury to building personnel. Particular care must be taken for any work which will be done during building's normal operation.

1.03 IDENTIFICATION OF PIPING

1. Use color scheme for painting listed in "Scheme for identification of Piping System", ANSI A-13 and Rust-Oleum Corporation Form # 117 or approved equal. Paint identifying band of color near each valve and fitting, on both sides of pipes passing through wall, and on long pipe runs approximately every 30' (closer when directed), throughout building.

2. All new exposed pipe in any occupied area, including insulation, hangers, supports and all appurtenances, shall be painted color to match existing. All equipment without factory finished paint shall be painted. All painting shall receive two coats as specified for painting (see Section 15010).

Color Coding

Hot Water Primary Supply Return	Red
Hot Water Secondary Supply Return	Dark Red
Chilled Water Supply Return	Blue

3. Stencil on pipe, near each valve, name of pipe contents in abbreviated form, size of pipe, and arrow indicating direction of flow. Place legend in such location that it can be read from floor. Size of stencil letters shall vary with the size of pipe.

4. Seaton "SETMARK" pipe markers or approved equal are acceptable.

1.04 TESTING

1. At the completion of all work, and before any covering is applied, all piping except drainage shall be tested hydrostatically at a pressure equivalent to 150% of the working pressure or to material test pressure, if lower. All piping concealed in any manner shall be tested before being concealed. Maximum drop in pressure permissible shall be 2 psi in 24 hours.

2. Testing shall be in accordance with ANSI B31.1 in all test gauges, traps and all other apparatus which may be damaged by the test pressure shall be removed or valved off from the system before tests are made.

3. Where new pipe is shown or required to be connected to existing pipe or equipment, existing and new pipe shall be tested. Tests for new pipe and equipment in existing areas shall be done only after building normal occupied period. All tests shall be done in such a manner as to avoid injury to building personnel and protection of existing construction from damage which may occur, due to test or failure of test and/or tested material.

4. In existing building, all required tests on new and/or existing systems shall only be done after normal school hours. All tests done in building shall be done in such a manner as to avoid injury to building personnel and damage to existing and/or new construction. Protect all new and existing construction from damage which may occur as a result of the test or failure of test material.

1.05 PRESSURE RATINGS

1. All equipment and materials shall have a working pressure as determined by A.S.M.E. (or similar body), of not less than 125 P.S.I.

1.06 SLEEVES

1. All pipes passing through construction shall be fitted with flush sleeves of sufficient diameter to pass the insulation. Sleeves shall be 20 USG galvanized iron, except in masonry, where steel pipe sleeves shall be used. Sleeves in waterproof construction shall be steel pipe, waterproofed with modular mechanical synthetic rubber seals equivalent to "Link Seals" (Thunderline or approved equal). In floors, they shall extend an inch above the floor.

2. In fire divisions, sleeves shall be constructed of fire-retardant material and shall be installed to maintain the fire integrity of the fire division.

3. All materials and construction methods shall be installed in accordance with the manufacturer recommendations and the requirements of the IBC Code or any other applicable code.

PART 2 PRODUCTS

2.01 PIPE

1. Steel pipe shall be Schedule 40; electric welded, ASTM-A53, Grade A, plain or galvanized as specified under applicable system. Schedule 80 shall be used for condenser water.

2. Copper tubing shall be hard temper "Type L" except that all piping underground shall be "Type K", conforming to ASTM-B-88.

2.02 PIPE FITTINGS

1. All welded fittings shall be of the same thickness and material as the pipe meeting ASTM-A234. Branch connections shall be made with Weldolets or welding fittings.

2. All flanges shall conform to A.S.A. B-16 using gaskets suitable for the service.

3. Cast iron screwed fittings shall be 125 psi cast iron, ASTM-A-126.

4. Malleable iron fittings shall be 150 psi wsp conforming to ASTM-A-338.

5. Fittings for copper tubing shall be wrought copper of the Solder Type conforming to A.S.A. B16.22.

2.03 GATE, GLOBE AND CHECK VALVES

1. All valves 2" or smaller shall be ball valves and shall be bronze solder end valves in copper tubing and screwed end in other lines. Globe and swing check valves shall be 125 psi WSP, 200 psi WOG with renewable composition disc.

2. All valves 2½" or larger shall be 125 psi WSP, 200 psi WOG bronze mounted, silicon bronze stem, outside screw and yoke, blotted bonnet and follower gland, iron body, flanged end, wedge gate valves. Valves shall be provided with back seat to permit packing under line pressure. Globe and Swing check valves shall be of similar construction with renewable, regrinding, bronze disc and seat. Provide chain operators for all valves above 8' AFF.

3. All valves used for throttling shall be globe type with 500 Brinnel full plug and removable seat.

4. Non-slam checks shall be used on all pump discharges, elsewhere at contractor's option.

2.04 PLUG AND BALL VALVES

1. Plug and Ball Valves shall be 150 psi WOG with full port. Valves used for balancing shall have infinite throttling handle and adjustable stops. All valves bubble tight shut-off.

2. All valves 2½" or larger shall be 125 psi WSP, 200 psi WOG bronze mounted, silicon bronze stem, outside screw and yoke, bolted bonnet and followed gland, iron body, flanged end, wedge gate valves. Valves shall be provided with back seat to permit packing under line pressure, Globe and Swing check valves shall be of similar construction with renewable, regrinding, bronze disc and seat.

2.05 UNIONS

1. Unions shall be installed for the removal of equipment.

2. Unions 2" and smaller in copper tubing shall be all brass, ground joint, solder end. In other lines, screw end, malleable iron, 125 psi WSP, 300 psi WOG of the ground type.

3. Unions 2½" and larger in copper tubing shall flanged pattern, all brass, solder end. In other lines, 125 psi WPS-175 psi WOG, cast iron flanged pattern, black or galvanized to match piping.

2.06 STRAINERS

1. Strainers to be self-cleaning ("Y" type), cast iron body installed ahead of all control valves and pumps; screens to be Monel or stainless steel with proper perforations for the service, ends to be screwed to 2" size, flanged for sizes 2½" and larger.

2.07 ESCUTCHEON PLATES

1. Where any pipe passes into a finished space, there shall be provided a solid brass, chrome plated, escutcheon plate held to the pipe mechanically or fastened to the building construction.

2.08 ANCHORS

1. Anchors of approved design shall be provided where shown or required for the property control of the stress due to expansion. Anchors shall be heavy metal sections securely fastened to the building construction.

2.09 ANCHOR BOLTS

1. This Contractor shall furnish and install anchor bolts as required for the equipment. Anchor bolts shall be DECO (or approved equal) standard anchor with floating nut, adjustable ½" in any direction. Grout all bases.

2.10 DRIP PANS

1. Provide drip pans of adequate size for all pipes and equipment carrying liquid or liquid vapors where pipes pass over areas or equipment requiring protection. Drip pans shall be constructed of stainless steel, minimum 20-gauge, provide 3" deep pan. Provide drain line to closest sanitary line (minimum 2" diameter).

2.11 ACCESS PANELS

1. Furnish and install access panels not smaller than 18"x18", for access to all concealed valves, automatic dampers, equipment, accessories, etc.

2. Access panels shall be all steel construction with a 16-gauge wall or ceiling frame and a 16-gauge wall or ceiling frame and a 14-gauge panel door with not less than 1/8" insulation secured to inside of door.

3. Doors shall have concealed hinges and cylinder lock except doors for wall panels may be secured with suitable clips and countersunk screws.

4. Access panels shall be flush with finished wall or ceiling and shall be painted to match adjacent surfaces. Access panels behind finished surfaces shall have color coded marking on finished surface to indicate location of doors and type of equipment.

5. Access panels in fire rated construction shall be fire rated.

2.12 HANGERS

1. All piping shall be supported by hangers, concrete inserts, and insulation saddles conforming to MSS-SP-58.

2. Hangers for steel pipe and copper tube shall be spaced not over 8' or as required by applicable code.

3. Vertical runs of pipe shall be supported by riser clamps except that pipe 1¼" and smaller may be braced by galvanized malleable iron fasteners. A hanger shall be placed no further than 24" from each change in direction of piping.

4. Hangers for copper tubing shall be copper plated, and completely encircle the tubing. Hangers for insulated pipe shall be outside insulation with sheet metal between insulation and hanger.

5. Hangers shall not be connected to or supported from other pipe, conduits or any other equipment, and shall only be supported directly from building structure.

6. All hangers shall be installed in strict accordance with manufacturers' requirements and good industry standards.

7 Where existing construction is disturbed, removed and/or modified to install new hangers, the existing construction disturbed shall be repaired and/or replaced and finished to match adjacent surfaces.

8. Provide saddles under all pipe, see Section 15180 for specifications. All saddles on exposed pipe shall be painted.

9. Where hangers, support pipe or equipment is exposed in finished spaces, any penetrations of finished surfaces by hanger or supports shall have escutcheons or device to cover opening. All hangers in finished areas shall be painted and done in a neat workmanlike manner. Where hangers or supports may cause injury or are below 8'-0", provide color coded foamed glass finished padding minimum 1½" thick. Padding to be installed so that there are no rough exposed edges. All padding to be installed with fastening devices; no tape allowed.

10. Provide Unistrut or approved equal for mounting of pipe where building structural elements are not adequate.

PART 3 EXECUTION

3.01 EXCAVATION AND BACKFILL

1. This Contractor shall do all excavating and backfilling necessary and repair finished surfaces that are disturbed. This Contractor shall remove or distribute all earth remaining as directed, and/or provide required backfill. Excavate all substances encountered to the depths and sections shown on drawings.

2. Excavation for pipes, manholes, catch basins, drain inlets, and other accessories shall have 12" clearance on all sides. Areas adjacent to any excavation shall be graded to prevent water running in.

3. Excavation shall not be carried below the required level, and if so carried shall be backfilled with gravel or sand, and tamp to proper compaction.

4. After proper inspection and tests all excavation shall be backfilled with approved material, free from large stones, clumps or frozen earth, wood and other objectionable material. This Contractor shall haul away excess material or provide additional fill as required.

5. Backfill for pipes shall be placed evenly and carefully around and over the pipe in six inches minimum layers. Each layer shall be thoroughly and carefully rammed by hand until one-foot cover exists over the pipe. The remainder of the backfill shall then be placed, moistened and compacted to a density equivalent to that of adjacent original materials using mechanical tamping machines.

6. Backfill for shall be placed symmetrically on all sides in one-foot maximum layers and shall be compacted with mechanical or hand tampers to density equivalent to 90% of laboratory density in accordance with ASTM-D698 test.

3.02 INSTALLATION OF PIPING

1. All fittings, offsets, etc., may not be shown. This Contractor shall determine their necessity by investigating conditions at the site. This Contractor shall use shop drawings for exact locations.

2. All piping above ground shall be run parallel with the lines of the building in the most direct manner, concealed in furred spaces where possible.

3. Pipes shall be cut accurately and placed without springing or forcing all burrs removed.

4. All water piping inside the building shall be properly graded to drain equipped with a ½" hose outlet and angle drain valves.

5. All changes in size of piping shall be made by reducing fittings; no bushing will be permitted unless approved.

6. This Contractor shall determine, with approval, where expansion joints, loops or anchors will be required due to space restrictions prohibiting proper runout flexibility.

7. Valves, air vents, balancing cocks, etc., shall be placed in accessible positions, and flush metal access doors, (18"x18" minimum size), with necessary lintels, etc., provided where they are concealed.

8. All piping shall be located to prevent freezing. Where pipe is located in areas subject to freezing, provide freeze protection and insulation.

9. This Contractor to coordinate all pipe runs with other contractors. Where coordination of this contractors' work requires a modification of his equipment, layout, pipe runs, offsets in pipe, or additional pipe from what is diagrammatically shown on contractor documents, this shall be done at no additional cost to owner.

3.03 JOINING PIPE

1. Steel piping shall be of welded or flanged construction in sizes 2½" and larger; screwed or welded construction in sizes 2" and smaller. All screwed fittings to be cast iron unless otherwise specified. All threads shall be conformity with A.S.A. B-21.

2. All screwed pipe joints shall be made with Teflon Dry Thread Sealer (3M-#48) or approved equal; applied to male threads only.

3.04 JOINING DISSIMILAR METALS

1. Where copper is jointed to steel, joints shall be made by means of brass or bronze adapter in a cast iron fitting or by means of an electrochemically insulated union. Hangers supporting copper tubing shall be copper or copperized. Copper tubing lines shall not be, even temporarily supported or secured to ferrous metals.

3.05 FOUNDATIONS

1. Foundations shall be provided by this Contractor for all equipment mounted on concrete floors and shall be of concrete construction not less than 6" high unless otherwise shown. Details of all foundations shall be submitted for approval.

2. Foundations or footings for structural steel supports shall be carried to a point not less than 12" below the underside of the floor slab, except where rock is encountered at less depth, then foundation may set on the rock. All foundations shall be built to templates and reinforced as required by the load to be imposed upon them.

3.06 STRUCTURAL STEEL

1. This Contractor shall furnish and install all structural steel, supports, braces, hangers, etc., required for his contract unless shown as being furnished and/or supplied by others.

2. Structural steel shall conform to "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings", of the American Institute of Steel Construction, and where applicable, "Code for Welding Building Construction", of the American Welding Society.

3. All structural steel design for support of HVAC system shall be the responsibility of this Contractor. The design shall be prepared by a Registered Professional Engineer licensed in the state where work is being performed, whose seal should be affixed to plans.

3.07 PLENUM AREAS

1. Any duct plenum area, ceiling or room plenum shall not contain any combustible material, and all wiring and/or piping shall be suitable and approved by local authorities for plenum installation.

END OF SECTION
15110.6290

SECTION 15180 - INSULATION

PART 1 GENERAL

1.01 SCOPE

1. All surfaces throughout the work shall be insulated with fiberglass insulation as indicated in applicable section.

2. Removal and replacement of existing insulation for new work.

3. All insulation thickness and R Value shall be installed in accordance with ASRAE 90.1, latest edition.

PART 2 PRODUCTS

2.01 PIPE INSULATION

1. All piping throughout the work shall be insulated with fiberglass pipe insulation in thickness, indicated in Part 3.04, of high density and with jacket indicated in the applicable section with the exception that outside, or areas exposed to freezing; thickness shall be doubled.

2. All pipe shall be insulated in such a manner as to prevent condensation on all pipe surfaces and appurtenances. All pipe insulation to be tightly butted and sealed to prevent condensation.

3. Vapor barrier jackets shall have self-sealing lap joint, and joints between sections shall be covered with a 4" wide strip to self-sealing vapor barrier materials. Aluminum bands shall be applied, two to a section on all indoor insulation.

4. On outdoor installations, provide double insulation thickness with 20-gauge stainless steel jacket, stainless steel banded or stainless-steel screws. Note: All hot water heating pipe to be heat traced.

5. All pipe exposed in finished areas shall be painted color selected. All other pipe exposed in any finished area. Where pipe is located below 8'- 6" AFF and all pipe exposed in Shops, Locker Rooms, Gym and Cafeteria and any other location; insulation shall have stainless steel jacket same as indicated for outdoor pipe, except with no exposed joints or seams.

6. All Refrigerant piping (except hot gas) throughout the work shall be insulated with a 1/2" (nominal wall thicknesses) mold resistant flexible elastomeric, thermal insulation, Insulation must be acceptable for use in air plenums and conform to NFPA 90A and NFPA 90B requirements and meet or exceed ASTM C 534, Type I - Tubular Grade I Standard.

7. All pipe insulation located inside of building shall be plenum rated.

2.02 DUCT INSULATION

1. All new supply ducts in unconditioned spaces shall be insulated with high density fiberglass blanket insulation, UL labeled faced with aluminum foil covered, glass reinforced, flameproof, kraft paper.

A. Duct insulation R Values shall be in accordance with 2015 International Energy Conservation Code, Section C403.2.9.

Unconditioned Space – R=6.0 per requirements indicated for the climate zone of the building.

2. All supply and return ductwork in Boiler Rooms and outside of building insulation envelope shall be insulated as above in 3" thickness.

3. Duct insulation and linings shall not glow, flame or smolder when tested at their rated temperatures in accordance with ASTM-C-411, test temperature 250° F. or greater.

4. Duct coverings shall not penetrate fire resistance rated enclosures nor partitions required to be fire rated. Duct insulation at rated enclosure shall have insulating material in accordance with applicable code.

5. Duct supports shall not penetrate duct insulation.

2.03 INSULATION AT ROOFTOP UNITS

1. Insulate space between bottom of rooftop unit and deck with insulation.

2. Decking shall be maintained inside the rooftop unit roof curb to a clearance of ¼" maximum around all duct drops, but never contact the duct.

A. Pack all air gaps around duct drops for return and supply with HUSH BATT and seal with HUSH SEALAMT HSAC-100.

3. HUSHCORE Model DS-52, or approved equal, In-Curb Composite Acoustical Treatment Performance

A. The combination of all layers shall be tested for Sound Transmission Loss in accordance with procedure ASTM E-90-10. The assembly shall be rated at not less than STC-52 with 1/3 octave performance values as listed below for sound radiation thru the deck inside the curb.

Freq. (Hz)	80	100	125	160	200	250	315	400	500	630	800	1K
TL (dB)	26	27	33	32	35	42	45	45	50	56	29	60

Freq. (Hz)	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	STC
TL (dB)	62	63	64	65	67	71	74	78	80	80	52

4. The products are manufactured by BRD Noise & Vibration Control, Inc., Wind Gap, PA, 610-863-6300, infor@brd-noise.com.

PART 3 EXECUTION

3.01 INSTALLATION OF PIPE INSULATION

1. All pipe insulation shall be applied over dry, clean surface with joints tightly butted and jacket firmly and securely attached and smoothed. Insulation shall be continuous through wall, floor or ceiling openings and sleeves.

2. All valve bodies and fittings shall be insulated with preformed fittings of thickness equivalent to adjacent insulation and jacketed with same material. At Contractor's option, except in plenums, outdoors and where not permitted by code; provide precut fiberglass insulation blanket of same insulation thickness as adjacent insulation with a preformed snap on type molded PVC jacket, cover edges with vapor barrier adhesive or vapor barrier tape.

3. Provide metal shields under all hangers or pipe supports on outside of insulation; on roller supports provide pipe shoe cavity with insulation. Insulation inserts shall be heavy duty insulation material length 12" up to 6" dia. pipe 16" long on 8" & 10" pipe & 22" long on 12" pipe and larger. Where insulation cannot support pipe, provide Kaylo or approved equal insulation. Provide vapor barrier. **HANGERS SHALL NOT PENETRATE PIPE INSULATION**. Paint shields on exposed pipe same color as pipe. If pipe is not painted and insulated, paint same color as insulation (white).

4. On outdoor insulation, double insulation thickness, provide stainless steel jacket and removable stainless-steel jacket at fittings and valves.

5. All pipe connections to equipment shall include all insulation to cover openings to unit unless manufacturer provides method of closure.

6. All pipe insulation to be installed in accordance with insulation manufacturers' requirement to provide moisture tight and thermal performance per specifications and manufacturer's requirements.

7. Pipe feeding radiation in enclosures, no insulation is required.

8. All pipe insulation to be continuous with no breaks in vapor barrier. All pipe supports shall have sheet metal shields.

3.02 INSTALLATION OF DUCT INSULATION

1. Insulation shall be pasted to the duct using "3M" EC-321 or approved equal with joints butted and taped with "Scotch No. 47A" or approved equal flame-resistant vinyl baked tape and dry dust free surface using nylon sealing tool. Tape to be used to seal joints only, NOT TO HOLD INSULATION TO DUCT.

2. In lieu of pasting insulation to duct it may be impaled on 12-gauge mechanical fasteners welded or glued on 12" to 18" centers with minimum of two (2) rows, per side-seal protruding pin with mastic and secure with metal cap.

3. Duct coverings shall not penetrate fire resistance rated enclosures nor partitions required to be fire rated.

4. Insulation shall fit between seams and stiffeners. All joints tightly butted.

5. All duct insulation shall be installed per manufacturers' requirements.

3.03 EQUIPMENT INSULATION

1. All equipment containing fluids whose piping is specified to be insulated or whose surface temperatures will be low enough to cause condensation (60° F.), or high enough to burn persons touching same (110°F.), shall be insulated with a minimum of 1½" thick fiberglass block firmly butted and wired in place, and covered with ½" thick coat of insulating cement troweled over one-inch galvanized hexagonal wire mesh and cement troweled smooth. Metal corners beads shall be applied to protect corners.

3.04 INSULATION THICKNESS

1. Minimum pipe insulation thickness shall be in accordance with the International Energy Efficiency Code (Latest applicable edition), Table C403.2.1 or local requirements and the following table:

Fluid Design Operating Temp. Range (°F.)	Insulation Conductivity		Nominal Pipe or Tube Size (in.)				
	Conductivity Btu·in./(h·ft²·°F)	Mean Rating Temp. °F	<1	1¼ to <½	1½ to 4	4 to <8	≥8
141-200 Hot Water Heating	0.25-0.29	125	1.5	1.5	2.0	2.0	2.0
40-60 Chilled Water	0.21-0.27	75	1.0	1.5	2	1	1

A. For hot water piping small than 1½" and located in partitions within conditioned spaces and/or in pipe enclosures, reduction of these thickness by 1" shall be permitted, but not to a thickness less than 1".

B. For direct-buried heating and hot water system piping, reduction of these thicknesses by 1½" shall be permitted (before thickness adjustment required, but not to thicknesses less than 1".

2. Where piping runs outdoors, double insulation thickness.

3. Provide heat tape (electric) to prevent freezing of outdoor piping and new/existing outdoor condenser water pipe, domestic water pipe, chemical treatment pipe, pipe and all other piping subject to freezing. Electric heat tape to be Chromalox Type M1 cable or approved equal, furnished with all controls, power wiring and appurtenances. Size and capacity per manufacturers' requirements. Provide interface to DDC system for alarm conditions.

END OF SECTION
15180.6290

SECTION 15190 - TESTING AND BALANCING

PART I GENERAL

1.01 SCOPE

1. Provide all labor, materials and miscellaneous items as required to perform all the testing and balancing of ALL air and water system devices and/or systems indicated on plans and/or in the specifications as the mechanical contractor's scope of work.

2. Provide all labor, materials and miscellaneous items as required to perform the testing and balancing of ANY air and water system devices and/or system indicated on plans and/or in the specifications to be provided by TAB contractor.

3. The TAB contractor is to furnish and install all sheaves and pulleys for new and existing HVAC equipment where indicated on plans and/or in the specifications.

4. The TAB contractor shall rebalance 10% of the air and water devices and/or systems after the final balancing report is completed and reviewed by the mechanical engineer. The rebalancing scope shall be as directed by the mechanical engineer's review comments of the final balancing report.

1.02 APPROVALS

1. All work to be done in accordance with the following:

   A. American National Standards Institute (ANSI): Specification for Sound Level Meters

   B. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE): ASHRAE Handbook of Fundamentals latest edition.

   C. Associated Air Balance Council (AABC): 2002 AABC National Standard for Total System Balance

   D. National Environmental Balancing Bureau (NEBB): 1998 Procedural Standards for Testing-Balancing Adjusting of Environmental System; 2nd Edition.

1.03 TESTING AND BALANCING

1. Upon completion of the installation and field testing, performance test and adjust all air, water, and/or steam system to provide the air volume and water flow quantities indicated and sound levels required. Accomplish all work in accordance with the agenda and procedures specified by AABC and standards of the NEBB. Correct air and water system performance deficiencies disclosed by the test before balancing the systems.

1.04 AGENCY QUALIFICATIONS

1. This Contractor shall obtain the services of a qualified testing organization to perform the testing and balancing work. Prior to commencing work the testing organization shall have been approved by the Architect/Engineer.

2. The criteria for determining qualifications shall be membership in the AABC, or certification by the NEBB, or the testing organization shall have submitted proof to satisfy the Architect/Engineer that the organization meets the technical standards for membership of the AABC.

1.05 AGENDA

1. Review plans and specifications prior to installation of any of the affected system. Submit a written report to the architect indicating any deficiencies in the system.

2. An agenda shall be submitted and approved by the architect prior to start of testing and balancing work. Include the following:

   A. General description of each system with its associated equipment, and operation cycles.

   B. A complete listing of all flow and air terminal measurements to be performed.

   C. Proposed selection points for sound measurements.

   D. Specific test procedures and parameters for determining specified quantities; e.g. flow drafts, sound levels, etc.

   E. Samples of forms showing applications of procedures and calculations.

1.06 PROCEDURES, GENERAL

1. Adjust systems and components thereof that perform as required by drawings and specifications.

2. Operating tests of heating and cooling coils, fans and other equipment shall be of not less than 4 hours duration after stabilized operating conditions have been established.

3. Method of application of instrumentation shall be in accordance with the approved agenda.

4. Instruments used for measurements shall be accurate. Calibrate each test instrument by an approved laboratory or by the manufacturer. The engineer has the right to request instrument recalibration, where accuracy of readings is questionable.

5. Comply with manufacturer's certified instructions.

6. Do not install permanently installed equipment for the tests, e.g., gauges, thermometers, etc., until just prior to the tests to avoid damage and changes in calibration.

1.07 BALANCE & BALANCE REPORT SCHEDULE

1. The HVAC contractor shall provide the balance report and submit to the Architect/Owner as a shop drawing, which shall be distributed and reviewed in accordance with the general conditions.

2. Any and all work required for balancing of the system shall be done prior to the HVAC contractor submission of Billing for Substantial Completion.

3. Balancing shall include initial and final balancing. All adjustments to the system to provide the required flows, pressure temperatures, etc., shall be completed. Where adjustments to the system are required to provide proper specified performance, this work shall be done at no additional cost to Owner.

4. Where any modifications, adjustments, replacement of equipment, removal and replacement is required to provide proper system performance, this work shall be done by the HVAC contractor at no additional cost to owner.

5. Where any of the above required modifications, etc., results in the removal, replacement, repair, modification, and/or other work of other prime contractors or subcontractors, the cost of this additional work shall be the responsibility of the HVAC contractor and shall be completed at no additional cost to owner.

6. The final approved balance report shall be provided to the inspecting authority having jurisdiction prior to substantial completion and is a condition to receive the Certificate of Occupancy or Temporary Certificate of Occupancy.

7. It is the HVAC contractors' responsibility to have the system completed and ready for balancing to meet the specified performance, construction and completion schedules per the General Conditions.

8. The requirements of this specification are applicable to all phased projects. For phasing, refer to General Conditions.

PART 2 EXECUTION

2.01 AIR SYSTEMS GENERAL REQUIREMENTS

1. All systems shall be balanced to provide air flow rates measured and adjusted to within 7.5% of the design rates. Provide a typed or computer-generated balance report using standard AABC forms and industry accepted practices for presentation. Where conditions do not allow for system to achieve the specified values, is to be clearly indicated prior to submission of balance report as a separate professionally prepared industry standard form.

2. Review of Documents - It shall be the responsibility of this Contractor and balancing contractor to thoroughly review the design drawings prior to submission of shop drawings and indicate where there may be possible problems with accessibility to equipment to allow for proper balancing or where system design will not allow for proper balancing and provide written description of possible problems. The balancing contractor shall review pipe and sheet metal shop drawings and shall provide written confirmation that this has been done. Coordinate with this Contractor for locations of all volume control devices. Where volume control devices are required for proper balancing of the system, they shall be provided by this Contractor at no additional cost to Owner.

3. Air systems shall be balanced in a manner which shall first minimize throttling loses, then fan speed shall be adjusted to meet design flow conditions.

4. After completion to tests, adjustments and balancing under minimum fresh air conditions, set the system for 100% fresh air. Repeat the total CFM tests as specified above to check field versus design conditions. The results under 100% fresh air cycle shall agree with conditions found under "minimum fresh air operation" before the system is considered to be in balance. Adjustments of the proper dampers shall be made to achieve balance.

5. This Contractor shall include as part of his bid, cost to rebalance system after initial and final adjustments based on field conditions, owners' request or problem areas. For purposes of the bid, the contractor shall assume a maximum of 10% of all air devices to be rebalanced, to include rebalancing of the fans associated with the air devices.

6. This Contractor shall be certified by N.E.B.B. or A.A.B.C.

7. This Contractor shall notify Owner or his representative in a timely manner prior to balancing system so that if they elect, they may accompany balancing contractor.

8. The system shall be commissioned as specified and all balancing shall be done accordance with time schedule as specified above and in General Conditions.

2.02 AIR SYSTEM PROCEDURES

1. Adjust all air handling systems to provide the required design air quantity to, or through, each component.

2. Adjust equalizing devices to provide uniform velocity across the inlets.

3. Use flow adjusting (volume control) devices to balance air quantities only.

4. Balancing between runs (submains, branch mains, and branches): Use flow regulating devices at, or in, the divided - flow fitting.

5. Final Measurement of Air Quantity: Make final measurements of air quantity, after the air terminal has been adjusted to provide the optimum air patterns of diffusion.

6. Fan Adjustment: Total air system quantities, generally, shall be varied by adjustment of fan speeds.

7. Except as specifically indicated herein, make pitot tube traverses of each duct to measure air flow therein.

8. Pitot tube traverse may be omitted if the duct serves only a single room or space and its design volume is less than 2,000 cfm.

9. Where ducts' design velocity and air quantity are both less than 1000 (fpm/cfm), air quantity may be determined by measurements at terminals served.

10. Test holes shall be in a straight duct, as far as possible downstream from elbows, bends, take-offs, and other turbulence generating devices.

11. Air Terminal balancing: Measurement of flow rates by means of velocity meters applied to individual terminals shall be used only for balancing. Measurement of air quantities at each type of air terminal (inlet and outlet) shall be determined by the method approved for balancing agenda.

12. The volume dampers, splitters and deflectors shall be adjusted so that the air velocities and volume will be as specified.

13. A further balance shall be made on temperature basis to maintain uniformity throughout, if so directed.

14. With the fan supply set to handle normal minimum outdoor air, the balancing firm shall perform the following tests and compile the following information.

    A. Air Handling Equipment

        1. Design Conditions

            a. CFM Supply Air
            b. Static Pressure
            c. Motor HP
            d. Code Required Outside air CFM
            e. Outside air CFM
            f. Fan RPM

        2. Installed Equipment

            a. Manufacturer
            b. Size/Model Number
            c. Motor HP, Voltage, Phase, Full Load Amperes

        3. Field Test

            a. Fan Speed
            b. No Load Operating Amperes
            c. Fan Motor Operating Amperes
            d. Calculated BHP

        4. Test for Total Air

            a. Size of discharge, return air, and outside air ducts.
            b. Number and locations of velocity readings taken and Static Pressure readings taken.
            c. Duct Average Velocity
            d. Total CFM
            e. Outside air CFM
            f. Return air CFM

B. Individual Outlets (diffusers, registers and/or grilles):

1. Identify each outlet or inlet as to location area and fan system, outlet, manufacturer, and type, outlet size, free area, core area, or neck area, required FPM and test velocity and CFM and test results.

2.03 WATER SYSTEM PROCEDURES

1. Adjust heating, cooling, and condensing water systems to provide required quantity to, or through each component.

2. Measure water quantities and pressures with calibrate-meters.

3. Use venturi tubes, orifices, or other metering fittings and pressure gauges. Adjust systems to provide the approved pressure drops, prior to the capacity testing. Where flow metering fittings are not installed, measure temperature differential across the heat transfer equipment.

4. Position automatic control valves for full flow through the heat transfer equipment.

5. Pumps

A. Design Data

- GPM
- Head
- RPM
- BHP

B. Installed Equipment

- Manufacturer
- Size
- Type Drive
- Motor HP
- Volts
- Cycles
- Phase
- Full Load Amperes

C. Field Test

- Discharge pressure at full flow and no flow.
- Suction pressure at full flow and no flow.
- Operating head and GPM.

6. All heat transfer equipment heating and cooling elements and primary and secondary takeoffs.

A. Design Data

- MBH specified
- GPM specified
- Entering Water Temperature (E.W.T.)
- Entering Air Temperature (E.A.T.)
- Water Temperature Drop (W.T.D.)
- Element type specified

7. Water quantities and capacity shall be measured by temperature taken.

2.04 AIR SYSTEM DATA

1. The certified report shall include for each air handling system the data as indicated in the applicable section of the specifications.

END OF SECTION
15190.6290

SECTION 15652 –SINGLE ZONE VAV ROOFTOP AIR-CONDITIONING UNITS

PART 1 GENERAL

1.01 SCOPE

1. Furnish and install all packaged, self-contained "single zone" rooftop variable air volume heat recovery air conditioning and heating units.

2. Leave equipment completely installed so that only the connection of auxiliary services is required to make ready for start up.

3. Provide all materials, miscellaneous equipment and interconnecting piping required for the proper functioning of the work.

1.02 APPROVALS

1. Unit shall be rated in accordance with ARI Standards 210/240 or 360 and 270, designed in accordance with UL Standard 1995. Unit shall be designed to conform to ANSI/ASHRAE 15, latest revision. Unit shall be UL tested and certified in accordance with ANSI Z21.47 Standards. Unit casing shall be capable of withstanding Federal test method Standard No. 141 (Method 6061) 500-hour salt spray test and unit shall have marine coating.

1.03 ENERGY EFFICIENCY

1. Units shall have minimum efficiency per ASHRAE 90.1-2004 and be tested in accordance with applicable ARI requirements.

1.04 FILTERS

1. Provide spare filters per Specification Section 15010.

2. Provide 2" thick fiberglass pleated filters with MERV rating of 13. Clogged filter switch installed at factory.

3. Provide 1" aluminum mesh pre- filters mounted over the outside air opening.

4. Provide factory installed electronic pressure differential for MERV filters interfaced with DDC system.

5. Units internal static pressure requirements shall include additional pressure loss of MERV 13 filter.

1.05 FACTORY TESTING

1. All factory assembled packaged equipment shall be factory tested including helium leak testing of the coils, pressure testing of the refrigeration circuit, and run testing of the completed unit. A certified factory Run test report shall be provided for each unit. **The "Run Test Report" shall be submitted to Owner for approval, prior to acceptance of unit for payment.**

2. All factory assembled packaged equipment shall be fully quality tested by factor run testing under normal operating conditions. Quality control system shall automatically perform via

computer; triple leak check, pressure tests, evacuation and accurately charge system, perform detailed heating and cooling mode tests, and quality cross check all operational and test conditions to pass/fail criteria.

3. Detailed report card will ship with each unit displaying status for critical tests and components.

4. If unit fails on any cross check, it shall not be allowed to ship. Serial numbers will be recorded by factory and furnished to contractor on report card for east of unit warranty status.

PART 2 PRODUCTS

2.01 AIR CONDITIONING UNITS

1. Furnish and install as indicated on plans, factory assembled and wired packaged rooftop mounted air-conditioning units. Units on steel dunnage shall have spring vibration isolation. Where equipment other than specified equipment is used and results in a different roof location and/or a different steel dunnage design, this Contractor assumes all costs (see Section 15010 "Equipment Deviations"). Cabinet shall be constructed entirely of G90 galvanized steel with the exterior constructed of 20 gauge or heavier material.

2. Units shall be completely factory assembled, piped and wired and shipped in one section. Factory tested per Specification Section 15010.

3. Unit exterior shall be color selected by Architect.

4. Access to filters, blower and heating section, maintenance shall be through hinged access doors with quarter turn handles. Access doors shall have full-length stainless-steel hinges and full perimeter gasketing. Air side service access doors shall have rain break overhangs.

5. All openings through the base pan of the unit shall have upturned flanges of at least 1/2" in height around the opening through the base pan.

6. The interior air side shall be entirely insulated on all exterior panels with 1" thick, 1 1/2 lb. density fiberglass insulation with double wall insulation liners and 304 stainless steel drain pans. Interior panels, interior floor, service doors, fan inlet cone, damper rack and filter rack in air stream shall have two-part polyurethane heat baked coating per ASTM B117-95.

7. Supply Fans

   A. Blowers shall be entirely self-contained on a slide deck for service and removal from the cabinet.

   B. Direct drive blowers shall be unhoused and have backward inclined blades. Adjustable V-belt drive shall be provided with a minimum rating of 140% of the motor nameplate brake horsepower when the adjustable pulley is at the minimum RPM.

   C. Blowers, drives and motors shall be dynamically balanced. Motors shall be premium high efficiency.

   D. VFD drive(s) (per Specification Section 15659) shall be factory mounted and wired to the fan motor(s). Motors for use with a VFD shall be premium efficiency inverter rated only.

Motors shall have ball bearings rated for 200,000 hours service and external lubrication connections.

9. Condensers

   A. Air-Cooled Condenser Section:

      1. Condenser fans shall be premium efficiency inverter rated with VFD and be low-sound type. Note – Fan HP to be increased by equipment manufacturer due to any increased power requirements.

      2. Condenser fans shall be premium efficiency inverter rated with VFD.

   B. Evaporator Coils

      1. Evaporator coil shall be copper tube with aluminum fins mechanically bonded to the tubes, sine wave rippled with galvanized steel end casings.

      2. Evaporator coil shall have equalizing type vertical tube headers with thermostatic expansion valve.

      3. Evaporator coil shall be furnished with a double sloped drain pan (fabricated of 304 stainless steel) for the positive drainage of condensate.

10. Refrigeration System

   A. Compressors shall be scroll type with internal thermal overload protection and mounted on the compressor manufacturer's recommended rubber vibration isolators. Compressors shall carry a 5-year non- pro-rated warranty. Each compressor shall be individually staged for capacity control. All units over 7 tons shall be multiple stages and shall have a minimum of 2 stages of capacity control. Compressors shall be mounted in an isolated compartment to permit operation of the unit without affecting air flow when the door to the compartment is open and isolated from the base pan and supply air.

   B. Each refrigerant circuit shall be equipped with thermostatic expansion valve type refrigerant flow control, automatic reset low pressure and manual reset high pressure refrigerant controls, Schrader type service fittings on both the high pressure and low-pressure sides and refrigerant liquid line driers.

   C. Unit shall be fully factory charged with R-410A refrigerant.

   D. Hot gas bypass shall be provided on all refrigerant circuits.

   E. First stage cooling shall be provided with condenser fan cycling to allow operation down to 35°F.

   F. Compressors shall have vibration isolation.

   G. Provide refrigeration accumulators to avoid short circuiting.

H. Provide acoustical blanket around compressor. Blanket shall be removable with inner and outer chemical resistant Teflon fiberglass cloth high density material and vinyl. Noise reduction in "A" weighting 100-5000H, 29.5 dba per ASTM test procedure E1222-87. Blanket shall be insulate LT450TAST-2" or approved equal; Shannon Enterprises, distributed by BRD

11. Gas Heat Section

A. Unit shall be provided with a gas ignition system consisting of an electronic igniter to a pilot system.

B. Unit shall have gas supply piping entrances in the unit base for thru-the-curb gas piping and in the outside cabinet wall for across-the-roof gas piping.

C. Unit shall heat using natural gas and be equipped with a modulating gas valve, adjustable speed combustion blower, stainless-steel tubular heat exchanger and electronic controller. The heat exchanger shall have 25-year non-pro-rated warranty. The completely factory mounted gas heating assembly shall be capable of operating at any firing rate between 100% and 30% of rated capacity. The combustion blower and gas valve shall both be capable of modulation. A supply air temperature sensor shall be factory wired for field installation in the supply air ductwork. The supply air temperature setpoint shall be adjusted on the electronic controller within the controls compartment. Provide full turndown to allow use of heat for single-zone VAV application.

12. Economizer

A. Economizer cycle shall include return air, relief air and outside air motorized dampers, outdoor and relief hood, and fully modulating control system with enthalpy changeover control and adjustable mixed air thermostat. Economizer control shall be capable of introducing up to 100% outdoor air. The control changeover from mechanical cooling to economizer operation shall be fully automatic through an adjustable enthalpy control device. Provide low leakage dampers, gravity or motorized relief air. Minimum damper leakage shall be per ASHRAE Standard 2010 90.1, Table 6.4.3.4.4.

Intake – 10 cfm/Sq.Ft. @ 1.0" wg.
Relief – Non-Motorized; 20 cfm/Sq.Ft. @ 1.0" w.g.
Motorized; 10 cfm/Sq.Ft. @ 1.0" w.g.

B. Economizer shall be fully integrated to allow system to operate with economizer and compressors between 75°F. (adj.) and 55°F.

13. Controls

A. The control system supplied and installed by the manufacturer for rooftop units shall only be controls that provide for safeties and economizer.

B. All controls for fan start/stop, cooling staging, heating control and de-humidification through hot gas reheat and other control functions shall be connected to the existing DDC system. Manufacturer shall coordinate wiring and control strategies with contractor.

C. All controls for the above shall be (where required for DDC interface and monitored) wired to a terminal strip. The existing DDC interface shall connect to terminal strip and provide all control functions and monitoring to achieve the existing and/or new sequence of operation.

D. All control functions and monitoring required for the unit including all points shall be interfaced to existing DDC system.

E. Control of supply air flow shall be factory installed variable frequency drive and from units' control system to reduce flow and refrigeration.

F. Unit shall be equipped with hot gas bypass control on the lead refrigeration stage to protect against evaporator frosting at low air flows and suction pressures.

G. Controller shall contain LEDs to indicate the power status, communications status, and fault conditions that arise during operation. Fault conditions indicated include supply air sensor failure, outdoor air sensor failure, space sensor failure, mechanical cooling failure, mechanical heating failure, low supply temperature alarm, high supply temperature alarm, control temperature cooling failure, control temperature heating failure, push button override, and zone override.

H. Fully modulating economizer with enthalpy limit shall have an outdoor air humidity sensor.

I. The unit shall be completely wired to a junction box, be complete with under voltage and overload protection, and so arranged that a single electrical power connection can be made. Time delay equipment shall be installed by the manufacturer so that no two motors can start together.

2.02 ATC COORDINATION

The intent of the specification is to have a fully integrated control system to allow new unit to provide sequence of operations to match existing and to allow the unit to be seamlessly interfaced to the existing DDC system. The following is the suggested demarcation between equipment and controls (DDC contractor) and shall not be used to limit scope or define responsibility.

1. Items supplied and installed by the rooftop unit manufacturer:

   A. Interface to existing DDC system for existing sequence of operations.
   B. Fan motor stop / start relay
   C. Refrigeration stop / start relays, contactors or sequencing modules
   D. Economizer control with enthalpy sensors
   E. Clogged Filter Switch
   F. Fan Failure Switch
   G. Discharge Air Sensor
   H. Power Exhaust Enable Relay
   I. Variable Frequency Drive
   J. Low Ambient Control
   K. Compressor protection via capillary bulb imbedded in the face of the evaporator coil.
   L. Compressor protection controller designed to open the compressor disable circuit based on a coil temperature of 10° (+/-) 5°.

2. Items supplied, installed, and wired by the DDC sub-contractor:

A. Zone sensor with set point dial
B. Interface to existing zone mounted CO2 sensor (as applicable)
C. New zone mounted humidity sensor
D. Freezestat for hot water coil Note: hard wire control point and alarm at BMS.
E. Exhaust fan interlock
F. New wall mounted Relative Humidity Sensor

3. Items installed by mechanical contractor:

   A. Interface with existing duct mounted smoke detectors or provide equipment mounted smoke detectors.

4. Items furnished and wired by the electrical sub-contractor:

   A. Interface with existing duct mounted smoke detectors (interlock wiring to unit's supply air fan starter by ATC contractor) or provide new equipment mounted smoke detector.

2.03 BIPOLAR IONIZATION

1. Furnish and install in all new rooftop units and replacement rooftop units, a needlepoint bipolar ionization unit.

2. The units shall be mounted within unit and located in accordance with rooftop and ionization manufacturer.

3. The units shall be sized based on the equipment air quantity and ionization manufacturers requirements.

4. Units shall receive power internally and may be 24V or 110V depending on unit.

5. The ionization unit shall be controlled from the rooftop unit internal controls, so that ionization unit is energized whenever unit is energized from the DDC system.

6. Ionization units shall be;

   - Rooftop units and central station air handling units; 0 - 2,400 cfm; Aerisa GPS Model LGPS-FC24-AC or approved equal.

   - 0-1,200 cfm fan coil units; Aerisa Model GPS-FC-2 or approved equal.

   - Rooftop units and central station air handlers; 2,400 cfm (6 tons) to 4,800 cfm, (12-1/2" tons); Aerisa Model GPS-FC-48-AC or approved equal.

   - Rooftop units 4,800 cfm to 10,000 cfm (25 tons); Aersia Model 5550 or approved equal.

7. Where unit size and air quantity are greater than 10,000 cfm, multiple smaller units shall be used. Where multiple units are used, the air quantity shall not exceed the ionization units' rated capacity.

PART 3 EXECUTION

3.01 EQUIPMENT INSTALLATION

1. All units shall be supported on existing roof curbs. The structural steel layout and existing curb is for the specified direct replacement unit basis of design equipment. Where equipment other than the specified equipment is to be provided, this Contractor to provide all additional steel required to support the units. This Contractor (for review and approval), prior to shop drawing submitted, shall submit the substituted equipment to the architect, structural engineer and steel contractor. Alternate design will be prepared, and this Contractor shall assume additional cost for design and modifications at no additional cost to Owner.

2. Where specified equipment locations differ due to field conditions from what is shown on plans, this Contractor to provide alternate layout and submit to architect and structural engineer and provide all modifications and additional costs associated with field conditions at no additional cost to Owner.

3. Submit supports and weights to structural engineer and/or steel fabricator for approval and/or coordination. Relocation of unit based on final layouts shall be the contractors' responsibility. The contractor shall provide all additional steel for units at no additional cost to Owner.

5. Units shall be painted color selected. Provide color chart for review and approval.

6. All disconnects and electrical devices that are installed externally on the unit by contractor are to be set at a maximum dimension of 6'-0" above roof deck. Contractor is cautioned that the units are to be installed on sloped curbs which are to match the new and/or existing roof slope. Contractor to verify exact slope of roof prior to equipment purchase.

END OF SECTION
15652.6290

SECTION 15655 - PACKAGED SPLIT SYSTEMS – EDUCATIONAL EQUIPMENT FURNISHED BY OWNER

PART 1 GENERAL

1.01 SCOPE

1. The split systems shall consist of installation of the Owner educational furnished equipment.

2. The equipment shall consist of all refrigerant pipe, furnace flues, self-contained controls and appurtenances. See Section 15010 for scope.

3. The equipment shall be indicated in Appendix.

1.02 APPROVALS

1. Equipment shall bear the UL label, be constructed, rated and installed with all applicable ARI and AGA Standards

PART 2 PRODUCTS

2.01 OUTDOOR UNITS

1. Connections - Only refrigerant piping and one (1) power supply connection shall be required for each unit.

2. Arrangement - Unit shall be arranged for pad, roof mounting.

2.02 GAS-FIRED FURNACES

1. Gas-fired furnaces shall be of size, capacity and arrangement as indicated on plans. Unit shall have electronic spark ignition, inducer blower, printed circuit board, burner assembly, atomized steel heat exchanger, blower door safety switch, insulated metal cabinet, filter and filter rack.

2. Provide all flues, control wiring of flue, flue condensate drainage system, refrigerant pipe, cubs, holes in general construction and roofing work.

3. Provide programmable room thermostat with fan switches, heat and cooling controls and dead band.

2.03 REFRIGERANT PIPE

1. Split system units are specifically designated as packaged equipment and as such, the manufacturer shall provide a complete design of the interconnecting piping and controls. As part of the submission of equipment, provide a compete refrigerant pipe design to include all pipe lengths, maximum pipe elevations and distances, as well as all other appurtenances. Equipment manufacturer shall be responsible to provide all refrigerant charge. Equipment manufacturer shall review the location and travel distances of refrigerant pipe and point out where there are problems prior to installation. All modifications of the system design shall be the responsibility of the HVAC contractor.

2. Refrigerant pipe shall be type "K" copper located within finished walls or furred-in or concealed in finished areas. All refrigerant pipe shall be properly supported, insulated and installed in accordance with manufacturers requirements.

3. Furnish complete refrigerant piping packaged pre-charged with fittings thermal expansion valve.

4. Furnish and install at each evaporator or liquid connection an externally equalized thermal expansion valve. Valve shall be capable of being serviced with the body flange in line.

5. Provide at each evaporator liquid solenoid valve with moisture resistant coil, manual operating stem and solder or flanged connectors with maximum one psi or less pressure drop at maximum design loading.

6. Insulate all refrigerant pipe per Section 15180.

7. Provide acoustical blanket around compressor. Blanket shall be removable with inner and outer chemical resistant Teflon fiberglass cloth high density material and vinyl. Noise reduction in "A" weighting 100-5000H, 29.5 dba per ASTM test procedure E1222-87. Blanket shall be insulate LT450TAST-2" or approved equal; Shannon Enterprises, distributed by BRD (610-863-6300).

PART 3 EXECUTION

3.01 EQUIPMENT INSTALLATION

1. Install equipment on vibration isolating base and necessary supporting steel.

2. Verify weight and mountings with Structural Engineer and/or Steel Fabricator for approval and/or coordination.

3. All refrigerant pipe shall be properly supported, insulated and installed in accordance with manufacturers requirements.

4. Provide condensate drain trapped with minimum ⅛"/ft slope to closest receptor.

3.02 CONDENSATE REMOVAL

1. Provide trapped condensate pipe sloped to proper reception. Condensate is to be drained to storm or sanitary systems as required by local codes. All pipe to be PVC pipe (except in plenums where type "L" copper shall be used). All pipe to be insulated with 1" thickness fiberglass pipe insulation with ASJ (minimum R = 4.0).

3.03 EXTERIOR REFRIGERANT CONDENSATE PIPE TO GRADE

1. All exterior condensate pipe at grade shall be mounted on exterior wall. All exterior refrigerant pipe on wall shall be covered. Covers shall extend past new wall opening and have manufacturers' end caps and appurtenances. Penetration of casing at condensers shall be field determined based on final refrigerant pipe layout. Multiple lines may be installed in one cover.

2. Provide refrigerant line covers on all exposed exterior refrigerant pipe for split system units.

3. Covers shall be weather-resistant, UV stabilized, PVC suitable for 4° F. to 140° F. and meets UL 94V-0, passing weather-resistant 2,000 hour test per JIS DO 205 standard.

4. All mounting screws shall be stainless steel. Provide snap on covers, elbows, T joints, reducers, entries, wall caps and appurtenances. Sizes shall be based on size and quantity lines being covered. Line sets shall be 2-1/4", 3", 4" and 6" sizes. Line set covers shall be Mitsubishi Line Hide or approved equal.

END OF SECTION
15655.6290

SECTION 15656 - DUCTLESS SPLIT SYSTEMS - EDUCATIONAL EQUIPMENT FURNISHED BY OWNER

PART 1 GENERAL

1.01 SCOPE

1. The split systems shall consist of installation of the Owner educational furnished equipment.

2. The equipment shall consist of all refrigerant pipe, furnace flues, self-contained controls and appurtenances. See Section 15010 for scope.

3. The equipment shall be indicated in Appendix.

PART 2 PRODUCTS

2.01 OUTDOOR UNITS

1. Arrangement - Unit shall be arranged for pad, wall or roof mounting as noted on drawings.

2. Provide seashore coating on condenser coil.

2.02 REFRIGERANT PIPE

1. Split system units are specifically designated as packaged equipment and as such, the manufacturer shall provide a complete design of the interconnecting piping and controls. As part of the submission of equipment, provide a complete refrigerant pipe design to include all pipe lengths, maximum pipe elevations and distances, as well as all other appurtenances. Equipment manufacturer shall be responsible to provide all refrigerant charge. Equipment manufacturer shall review the location and travel distances of refrigerant pipe and point out where there are problems prior to installation. All modifications of the system design shall be the responsibility of the HVAC contractor.

2. Refrigerant pipe shall be type "K" copper located within finished walls or furred-in or concealed in finished areas. All refrigerant pipe shall be properly supported, insulated and installed in accordance with manufacturers requirements.

3. Furnish complete refrigerant piping packaged pre-charged with fillings thermal expansion valve.

4. Furnish and install at each evaporator or liquid connection an externally equalized thermal expansion valve. Valve shall be capable of being serviced with the body flange in line.

5. Provide at each evaporator liquid solenoid valve with moisture resistant coil, manual operating stem and solder or flanged connectors with maximum one psi or less pressure drop at maximum design loading.

6. Insulate all refrigerant pipe per Section 15180.

   A. Provide factory installed adaptor to allow two (2) outside air connections.

PART 3 EXECUTION

3.01 EQUIPMENT INSTALLATION

1. Provide necessary supporting steel and verify weight and mountings with Structural Engineer.

2. Refrigerant pipe shall be type "K" copper and shall be properly supported and insulated per manufacturers requirements. Maximum length, minimum size supports and insulated in accordance with manufacturers' requirements.

3.02 CONDENSATE REMOVAL

1. Provide trapped condensate pipe sloped to proper reception. Condensate is to be drained to storm or sanitary systems as required by local codes. All pipe to be PVC pipe (except in plenums where type "L" copper shall be used). All pipe to be insulated with 1" thickness fiberglass pipe insulation with ASJ (minimum R = 4.0).

2. Controller and all wiring between controller, external points and unit.

3.03 EXTERIOR REFRIGERANT CONDENSATE PIPE TO GRADE

1. All exterior condensate pipe at grade shall be mounted on exterior wall. All exterior refrigerant pipe on wall shall be covered. Covers shall extend past new wall opening and have manufacturers' end caps and appurtenances. Penetration of casing at condensers shall be field determined based on final refrigerant pipe layout. Multiple lines may be installed in one cover.

2. Provide refrigerant line covers on all exposed exterior refrigerant pipe for split system units.

3. Covers shall be weather-resistant, UV stabilized, PVC suitable for 4° F. to 140° F. and meets UL 94V-0, passing weather-resistant 2,000 hour test per JIS DO 205 standard.

4. All mounting screws shall be stainless steel. Provide snap on covers, elbows, T joints, reducers, entries, wall caps and appurtenances. Sizes shall be based on size and quantity of lines being covered. Line sets shall be 2-1/4", 3", 4" and 6" sizes. Line set covers shall be Mitsubishi Line Hide or approved equal.

END OF SECTION
15656.6290

SECTION 15720 - WATER CIRCULATING SYSTEMS

PART 1 GENERAL

1.01 SCOPE

1. The work under this heading shall include the furnishing and installation of:

   A. All piping including connections to all equipment and installation of all control devices required for the proper functioning of the work. All insulated valve, materials and specialties necessary for the proper functioning of work. Connections to all equipment requiring connections to this water circulating systems whether furnished under this section or not.

   B. Connections to, modifications of, and/or removal of existing systems due to new work.

PART 2 PRODUCTS

2.01 PIPING MATERIALS

1. Hot Water Heating - Black Steel Pipe Schedule 40 or Copper Tube Type "L".

2.02 PIPE INSULATION

1. Hot water heating per Section 15180.

2. Condensate pipe per Section 15180.

2.03 AIR CONTROL DEVICES

1. Furnish and install air control devices of type and size shown on drawings or as required for proper system operation.

2.04 BALANCING FITTINGS

1. Furnish and install at the return end of each terminal device, fin tube circuit, unit heaters, coils, heat pumps, etc., a plug valve of same size as run-out.

2.05 AIR VENTS

1. Furnish and install Maid of Mist Automatic air vent, #71 or #74 (150 psi) or approved equal, on all unit heaters and all major drops in piping. Main air vents in equipment room to be Sarco #13W. All air vents shall be installed in such a manner that they are readily accessible for servicing.

PART 3 EXECUTION

3.01 SYSTEM BOIL OUT

1. Existing hot water heating system that has been disturbed is to be filled and sufficient detergent and dispersant added to remove all dirt, oil and grease. System shall be circulated for at least forty-eight (48) hours. The automatic make-up valve shall be checked to be sure it

is operating. The system shall have strainer baskets cleaned and replaced after each cleaning. The existing system shall be completely flushed a minimum of three times. This work shall be done in the presence of the construction manager and be done prior to commissioning.

2. After boil is out completed, initial water treatment shall be added.

3. All work shall be done under the instruction and supervision of a reputable local water treatment contractor of which firm shall be submitted for approval.

4. Where new pipe is shown to be connected to existing pipe, the new pipe shall be cleaned and tested as specified below. All cleaning shall be done with valves at connection to existing system closed. Provide method to fill and drain system.

5. This Contractor shall be responsible for furnishing and installing additional chemicals due to increased amount of water in system due to new pipe and equipment.

3.02 BALANCING

1. For balancing, see Specification Section 15190, and for pre-demolition balancing, see Specification Section 15191.

3.03 TESTS WATER PIPING

1. All piping shall be hydraulically tested for a period of four (4) hours to the following pressure or 1½ times working pressure; before insulation is installed, minimum 150 psi for chilled and hot water heating systems.

2. During the period of tests, all welds, joints, etc., shall be coated with a soap emulsion to test for leaks. Any leaks that are disclosed by the test shall be made tight and all joints left free of all imperfections. The four-hour test period shall continue after any imperfections have been perfected. All piping in chases or concealed shall be tested before they are covered.

END OF SECTION
15720.6290

SECTION 15760 - TERMINAL UNITS

PART 1 GENERAL

1.01 SCOPE

1. Furnish and install all terminal units. Leave equipment completely installed so that only the connection of auxiliary services is required to make ready for start up. Provide all materials, miscellaneous equipment and interconnecting piping required for the proper functioning of the work.

2. Removal of existing equipment and appurtenances.

1.02 CERTIFICATION

1. All fans shall have AMCA Certified ratings. All radiation shall be IBR rated. All equipment, where applicable, shall bear UL label.

PART 2 PRODUCTS

2.01 UNIT HEATERS

1. Unit Heaters shall consist of fan, factory finished baked enamel casings, and non-ferrous metal coils with fins mechanically bonded to tubes. Fan motors to be totally enclosed, designed for continuous operation. Unpainted ferrous parts to be cadmium plated.

2. Horizontal unit heater shall be furnished with double deflection louvers. Vertical unit heaters shall be furnished with adjustable diffusers. Provide fan guards where blades would otherwise be exposed.

3. Cabinet unit heaters shall be furnished with multiple centrifugal fans and be recessed mounted unless otherwise approved.

4. Units to be of manufacturer types, capacities and quantity shown on drawings.

5. Interface with central control system where applicable. Provide wall mounted thermostat.

2.02 HEAT TRANSFER COILS

1. Heating and cooling coils shall have tubes with aluminum fins securely bonded to the tubes to form a tight metal to metal contact. Coil header may be steel, copper cast iron. Tubes shall be staggered in the direction of air flow.

2. Casings shall be galvanized sheet steel with intermediate tube supports for coils exceeding 48" tube length. Headers shall be hydrostatically tested at 400 psi pressure before assembly, maintaining test pressure for two (2) hours without addition of pressurizing fluid. After assembly, each coil shall be tested at 250 psi air pressure, with coil submerged in water for at least fifteen (15) minutes. Unless otherwise noted, supply and return connections shall be on the same end of coil.

3. All water coils shall have drain and vent tappings. Cooling coils shall be pitches in direction of drainage.

2.03 CABINET UNIT HEATERS

1. Units shall be of manufacturer size, quantity and capacity as indicated on plans.

2. Cabinet type models shall have 16-gauge steel cabinets, except horizontal cabinet type which shall be of 18-gauge steel. Integral stamped inlet and outlet grilles shall have 15-degree downward deflection. Cabinets shall have heavy density glass fiber insulation and surfaces shall be phosphatized and painted with baked enamel; colors selected by Architect.

3. Vertical recessed and semi-recessed models shall have 16-gauge front panels attached directly to the basic unit.

4. All coils shall have aluminum plate-type fins mechanically bonded to the copper tubes suitable for working pressures up to 300 psig. Supply and return connections to be on same side of units.

5. Fans shall be direct driven, forward curved, centrifugal double width type. Motors shall be the permanent split capacitor type and have three (3) speeds. Filters shall be the Scott Foam type.

6. Verify wall thickness in field prior to installation or ordering, adjust mounting.

7. Provide wall mounted remote thermostat and all interconnecting services. Provide interface with central control system where applicable.

8. Where new wall mounted cabinet unit heaters are shown to replace existing, the new cabinet heaters shall match existing wall openings to the maximum extent possible. Where new heaters are of a different size (smaller), the wall opening shall have new cover (to match existing wall opening size). New cover shall be of same material and finish as cabinet heaters.

9. New ceiling mounted heaters (in suspended acoustical ceiling) shall have existing ceilings removed, modified and/or replaced due to new heater size.

2.04 BIPOLAR IONIZATION

1. Furnish and install a needlepoint bipolar ionization unit.

2. The units shall be mounted within unit and located in accordance with rooftop and ionization manufacturer.

3. The units shall be sized based on the equipment air quantity and ionization manufacturers requirements.

4. Units shall receive power internally and may be 24V or 110V depending on unit.

5. The ionization unit shall be controlled from the rooftop unit internal controls, so that ionization unit is energized whenever unit is energized from the DDC system.

6. Ionization units shall be;

   - Rooftop units and central station air handlers; 2,400 cfm (6 tons) to 4,800 cfm, (12-1/2" tons); Aerisa Model GPS-FC-48-AC or approved equal.

2.05 FINNED TUBE RADIATION

1. Enclosures shall be fabricated from 16-gauge zinc coated steel with baked enamel finish, color as selected by Architect. Enclosure shall be wall to wall with continuous modulating damper and access panel. Provide enclosure suitable for installation and access of control valves (where applicable).

2. Venetian type louvered outlet grilles shall be provided where indicated with pencil proof air discharge slots. Bottom and top of enclosure skirt shall have double break for lateral stiffness.

3. Furnish required bracket hanger assemblies with heavy flag brace for rigid front sheet and element support, and 20-gauge full back panel.

4. Provide all required accessories for a complete installation.

5. Enclosure shall be of dimensions, size as indicated. Element/enclosure combined capacity shall be as indicated. All covers components shall be furnished in baked enamel finish as directed by Architect. Enclosure shall be installed wall to wall with all necessary accessories, including column enclosures, end caps and joint trim etc. Radiation shall be size and capacity indicated.

6. Mount radiation 4" above finished floor unless otherwise indicated or recommended by manufacturer.

7. Install with shutoff valve on inlet and balancing valve on discharge with unions and drain valve.

8. Pedestal mounted radiation shall have supports painted (color selected).

9. Where control valves are installed in radiation, provide enclosure same construction as radiation.

PART 3 EXECUTION

1. Provide vibration isolation and all hanging materials required prior to hanging of any unit, verify supports.

2. Pipe Enclosure - All pipe exposed in space shall be enclosed in sheet metal (same construction as finned tube on radiation enclosure) furnished by manufacturer. This is to include vertical drops from ceilings. Enclosure shall not have any exposed seams or unfinished surfaces.

3. Provide a control system for equipment in accordance with ATC Section to provide all functions as specified in ATC Section. The control system supplied and installed by the equipment manufacturer for unit ventilators shall only be controls that provide for compressor and equipment safeties. All controls for fan start/stop/status, cooling staging, heating control, dehumidifications and other control functions shall be connected to the BAS controller. Manufacturer shall coordinate wiring and control sequences with the BAS/ATC contractor.

4. Where new piping is exposed in finished area, or where required for new piping and/or as indicated on plans, provide 16-gauge vertical sheet metal enclosure. Enclosure to be manufactured by the radiation manufacturer and match cabinet construction and color (factory painted). Verify all dimensions and conditions in field. Enclosure shall be installed so there are not exposed unfinished surfaces. See architectural plans for details. All fasteners shall not be visible.

5. Provide for each hot water heating coil, unions to facilitate removal of coil and control valve, automatic air vent, drain valve, shutoff valve, balancing valve, temperature gauges on supply and return and pressure gauges on supply and return.

END OF SECTION
15760.6290

SECTION 15810 - AIR HANDLING EQUIPMENT

PART 1 GENERAL

1.01 SCOPE

1. Furnish and install all fans and air handling units. Leave equipment completely installed so that only the connection of auxiliary services is required to make ready for startup. Provide all materials, miscellaneous equipment and interconnecting piping required for the proper function of the work.

2. Remove existing air handling units as indicated on plans.

3. Remove existing fans as indicated on drawings. Existing curb to remain. Provide adaptacurb or approved equal.

1.02 CERTIFICATION

1. All fans shall have AMCA Certified ratings for sound and performance and bear UL label and manufacturer be 150 9001 certified facility.

1.03 ENERGY EFFICIENCY

1. All motors shall be premium high efficiency type.

1.04 BALANCING

1. Balance all equipment per manufacturer requirements and Section 15190.

1.05 FACTORY TESTING

1. All factory assembled air handling units shall be factory tested including helium leak testing of the coils, pressure testing of the refrigeration circuit, and run testing of the completed unit. A certified factory Run test report shall be provided for each unit. **The "Run Test Report" shall be submitted to Owner for approval, prior to acceptance of unit for payment.**

2. All factory assembled packaged equipment shall be fully quality tested by factor run testing under normal operating conditions. Quality control system shall automatically perform via computer; triple leak check, pressure tests, evacuation and accurately charge system, perform detailed heating and cooling mode tests, and quality cross check all operational and test conditions to pass/fail criteria.

3. Detailed report card will ship with each unit displaying status for critical tests and components.

4. If unit fails on any cross check, it shall not be allowed to ship. Serial numbers will be recorded by factory and furnished to contractor on report card for east of unit warranty status.

PART 2 PRODUCTS

2.01 ROOFTOP CENTRIFUGAL FAN

1. Rooftop centrifugal fan shall be a spun aluminum, roof mounted, belt-driven, downblast centrifugal exhaust ventilator.

A. Fan shall be manufactured at an ISO 9011 facility and be listed by UL: 705. Fan shall bear the AMCA Certified Ratings Seal for Sound and Air Performance.

B. Fan shall be of bolted and welded construction utilizing corrosion resistant fasteners. The spun aluminum shall be bolted to a rigid aluminum support structure. The aluminum base shall have continuously welded curb cap.

C. Top cap shall have stainless steel quick release latches to provide access into the motor compartment. An integral conduit chase shall be provided through the curb cap.

D. The motor, bearings and drives shall be mounted on a minimum 14-gauge steel power assembly, isolated from the unit structure with rubber vibration isolators, enclosed in a weather-tight compartment, separated from the exhaust air stream.

E. Lifting lugs shall be provided. Unit shall bear an engraved aluminum nameplate. Nameplate shall indicate design CFM, static [pressure and maximum fan RPM. Unit shall be shipped in ISTA Certified Transit Tested Packaging.

F. Wheel shall be centrifugal backward include, constructed of 100% aluminum with aerodynamic aluminum inlet cone. Wheel shall be balanced in accordance with AMCA Standard 204-96.

G. Motor shall be premium efficiency heavy-duty type with permanently lubricated sealed ball bearings.

H. Bearings shall be for use in air handling applications. Construction shall be heavy-duty re-greaseable ball type in a cast iron pillowblock housing selected for a minimum L50 life in excess of 200,000 hours. Belts shall be oil and heat resistant, non-static type.

I. Drives shall be precision machined cast iron type, keyed and securely attached to the wheel and motor shafts. Drives shall be sized for 150% of the installed motor horsepower. The variable pitch motor drive must be factory set to the specified fan RPM. Fan shall have disconnect switch, backdraft damper, birdscreen, galvanized sound self-flashing curb.

J. Paint fan color selected. Provide name tag.

2.02 FANS

1. All fans to be manufacturer type, size, quantity and capacity shown on drawings. All rooftop fans shall have self-flashing Unibeam roof curbs and disconnect switch. All fan motors shall be premium high efficiency. All fans shall have backdraft damper.

2. Ceiling exhaust fans shall have acoustically insulated housings, maximum sound level rating of 4.6. AMCA Sones terminal box with cord, plug and receptacle inside the housing. Entire fan, motor and wheel assembly shall be removable from the housing. Motor speeds shall not exceed 1,500 RPM and all fan motors shall be suitably grounded and mounted on rubber-in-shear vibration isolators. Provide insulation on all discharge duct where required to prevent condensation. Units shall have metal face grille. Provide reinforced aluminum backdraft damper with continuous aluminum hinge rod and brass bushings. Pressure drops, fan speeds

and horsepowers to be adjusted for sound block. Units to have wall caps, brick vents, roof caps, where required and/or shown. Controls to be Solid State control, unless otherwise indicated. Where units are used for inline applications, provide inlet duct collar and delete face grille.

3. In-line centrifugal fans shall be constructed of welded steel, inlet and outlet diameters shall be the same size. The fan wheels shall be the backward curved centrifugal type with non-overloading characteristics, constructed with die-formed, aerodynamic blades, continuously welded to a flat radiant blackplate.

PART 3 EXECUTION

1. Provide all hanging materials and vibration isolation prior to hanging any unit, verify supports with Structural Engineer.

2. Provide prefabricated roof curbs for all roof mounted equipment. Unibeam Sonotrol type, minimum 12", all galvanized continuously welded construction with integral cants. Minimum 2" thick walls filled with insulation. Provide additional wood nailers so that fan bases rest level on curbs.

3. Provide wall caps or roof caps for ceiling fans flashed and secured as required.

4. All rooftop fans, gravity ventilators and utility sets shall be factory painted color selected.

5. All fans with duct connections or connections to building construction shall have flexible connections as specified in Section 15860.

6. All exhaust fans shall have backdraft dampers.

END OF SECTION
15810.6290

SECTION 15860 - DUCT SYSTEMS

PART 1 GENERAL

1.01 SCOPE

1. The work under this heading shall include the furnishing and installation of:

   A. All sheet metal work required for the various systems, including installation of control devices and connections to equipment and all materials and specialties required for the proper functioning of the work.

   B. All acoustical treatment required for the work as hereinafter specified.

   C. Removal, modification, expansion and/or connection of existing ducts for new work.

   D. Removal of existing ducts, flues and all appurtenances as indicated on drawings for execution of design intent of new systems.

1.02 CONSTRUCTION

1. All ducts shall be constructed of prime quality, re-squared, galvanized steel sheets in accordance with "Duct Manual and Sheet Metal Construction for Ventilating and Air Conditioning Systems" of the "Sheet Metal and Air Conditioning Contractors National Association", (SMACNA) Sections 1 and 2.

2. Gauges shall be as recommended for the use intended in the applicable SMACNA Manuals. All ductwork and other sheet metal shall be properly stiffened and supported as per the applicable recommendations of SMACNA Manuals. Only first quality, smooth, cold rolled sheets of the best grade steel shall be used and shall be guaranteed to double seam without showing fracture.

1.03 FLEXIBLE DUCTS

1. Use corrugated solid metal flexible duct for inlet connection to air control devices such as V.A.V. boxes, etc. Use corrugated aluminum or core polyester core (insulated) for connections on outlet-side of air control devices and low velocity runouts.

2. Ducts must be suitable for the service of acceptable fire rating and shall be insulated as specified for ductwork.

3. Flexible ducts shall be run in the most direct manner and shall be hung so that no bend has a centerline radius less than three times its diameter, maximum 12' +/-. Duct found not in compliance shall be removed and installed to comply with this section at no additional cost.

4. Substitution of flexible ducts for runouts shown as sheet metal or vice versa is acceptable but must be submitted for approval.

5. Flexible duct shall not pass through any wall, draft stopping wall, floor, ceiling or fire resistance rated assembly. Where flexible duct is shown thru these, provide sheet metal collar thru wall and minimum 6" either side.

6. All duct wraps, insulation and appurtenances shall be plenum rated.

7. Flexible duct on inlet to VAV boxes shall have minimum straight run of duct as required and recommended by the VAV box manufacturer.

8. Where flexible ducts are shown to be connected to return air or supply air plenum boxes, the duct connections shall be made to allow for installation of plenum boxes thru ceiling and/or down from roof.

1.04 EXPOSED SPIRAL DUCT

1. All exposed round duct in finished spaces shall be continuous spiral duct. Spiral duct shall be manufactured from galvanized steel ASTM-A-527-71. All ductwork is to be manufactured and installed with materials, fittings and joints designed to be exposed. Duct fittings, air devices and all appurtenances shall be prepared for painting as specified in Section 15010 and be painted color as selected by Architect. Where duct is specified to be acoustically insulated, United Sheet Metal Type "K-27"or approved equal duct to be used.

2. Where spiral duct is shown to be mounted between exposed steel or parallel with steel, the duct shall be installed at same slope roof steel.

3. Only where indicated on the drawings, all ducts shall be painted color selected. All duct, air devices, supports and appurtenances shall be painted.

1.05 EXPOSED NON-SPIRAL DUCT

1. All exposed duct not of spiral construction shall not have raised duct joints "Ductmate" or other type of similar joints. All ductwork is to be manufactured and installed with materials, fittings and joints designed to be exposed and unpainted (except where noted on the drawings). Duct to be painted color selected.

2. Only where indicated on the drawings, duct shall be galvanized prepared for painting using duct as indicated below. Galvannealed duct may be used.

1.06 PAINTING OF SHEET METAL DUCTS

1. Where exposed duct is to be painted, the following is a guide for surface preparation.

   A. Surface shall be clean, dry and free from spiral manufacturers' lubricants.

   B. Remove dirt and grease from galvanized spiral ductwork with water and a non-petroleum-based detergent (Simple Green, TSP, Krud Cutter, Dawn) and wipe dry with a clean cloth.

   C. Surface shall be free of foreign materials that will adversely affect adhesion or appearance of applied painted coating.

   D. Contractor shall use DTM (direct to metal) Sherwin Williams paint.

      1. Primer/Topcoat – Sherwin Williams B42W Series or approved equal
      2. Primer/Topcoat – Sherwin Williams B42T1 or approved equal

   E. All oil-based paint shall be in accordance with manufacturers' recommendations for surfaced preparation and primer requirement.

F. The use of alkaline oil-based paint shall not be used.

1.07 BALANCING AND TESTING

1. See Section 15190.

1.08 DIMENSIONS

1. Duct dimensions are INSIDE CLEAR DIMENSIONS: Increase metal duct size to allow for thickness of inside insulation.

PART 2 PRODUCTS

2.01 JOINTS

1. All connections of duct shall be installed in strict accordance with SMACNA standards, except that all exposed non-spiral duct with design pressure less than 2" W.C. or 2,500 fpm velocity in finished areas shall use streamline joints.

2. Mechanical joint fasteners, such as "Ductmate" or approved equal, will be allowed and shall be installed in strict accordance with manufacturers' requirements. Where mechanical fasteners are used, contractor shall coordinate joint locations with all other trades for clearances. Where use of mechanical fasteners result in an increased requirement for space and clearance and results in modification, removal, replacement, or new work for this Contractor or other contractors work; the work shall be done at this Contractors' expense and with no additional cost to Owner. These joints shall not be used for exposed duct in furnished areas.

3. Where any joint is installed in any duct below 7'0", installation shall have protection as specified under ductwork installation.

4. All joints shall be sealed as specified for air tightness.

2.02 DAMPERS

1. Furnish and install all dampers. Dampers for automatic operation shall be minimum leakage, multi-opposed type with neoprene balloon edge and snap steel side.

2. Outside air dampers for rooftop units shall be able to be closed within 30 seconds.

2.03 VOLUME DAMPERS, SPLITTERS AND ADJUSTABLE DEFLECTORS

1. Volume dampers shall be installed in all of the trunk and branch ducts, no exceptions. The balancing trade shall not depend upon register shutters or dampers for balancing. The sheet metal contractor shall submit shop drawings to the balancing contractor for his review of location, type, size, and quantity of balancing dampers. Where additional control devices or alternate methods of duct installation are suggested and/or required, these shall be provided, and all modifications made at no additional cost to Owner.

2. Volume dampers shall be Everlock locking type manual volume dampers as manufactured by Rossi HVAC Hardware or approved equal.

3. Bracket – Cold rolled Steel (ASTM A-1008), 18-gauge nominal thickness of 0.0478 with tolerance range of 0.0438 to 0.0518. single cut and formed bracket for use with 1.5" or 2.0" insulation wrapping or any other such stand-off applications. Finished with a white Chromate plating.

4. Handle and Thumb Trigger – Polyamide 66 (PA66), flame retardant, glass reinforced, "Zytel".

5. Retaining Spring – Ext. self-lock TX-75ST-ZF carbon steel SAE 1074 with zinc bright plating. C-scale Rockwell hardness 47 to 51.

6. Blades

   A. 4" to 14" dia. single blade (or disc). ASTM-A527 LFO G90, 20-gauge reinforced to equal strength of 18-gauge material.
   B. 3/8" full length bar fits through formed channel in center of damper blade.

7. Bars – 3/8" square aluminum bar.

8. Bearings

   A. Snap-in bearings for medium and low-pressure systems. Polyamide 66 (PA66), flame retardant, glass reinforced, "Zytel" or approved equal.
   B. B-lined bearings for lined duct. Polyamide 66 (PA66), flame retardant, glass reinforced, "Zytel" or approved equal.

9. Splitter dampers shall be installed where shown on drawings. Splitters shall be made of 18-gauge galvanized steel or heavier and shall be cross broken and flanged or hemmed for rigidity. Splitters shall be made easily adjustable and readily accessible for adjustment.

10. Adjustable deflectors and adjustable turning-vane devices for diverting air flow from a duct main into a branch duct shall be multi-blade assembly hinged at one end and so constructed that, as it is closed, the air passage between the blades narrows until no air passage remains when the assembly is in the fully-closed position.

2.04 FIRE DAMPERS

1. Fire dampers shall be provided and installed at all places where duct passes through a floor, fire wall, fire rated ceiling or other fire division, or as required by applicable codes.

2. Steel curtain dampers may be used in any system but are required 100% free area.

3. Fire dampers shall comply with UL-555 and shall bear the label of an approved agency. Fire dampers shall be installed in accordance with manufacturers' installation instructions.

4. Provide access doors at all fire dampers.

5. This Contractor shall, prior to shop drawing preparation, coordinate with general contractor, the location of all fire dampers based on architectural plans and/or existing construction. Where access doors are required behind any inaccessible area, this Contractor shall furnish and install access panels in general construction which shall be suitable for servicing of dampers.

6. Where due to existing and/or new construction of any trades, access to fire dampers are not possible prior to duct installation. This Contractor shall notify the architect and/or engineer.

2.05 ACCESS DOORS

1. Access doors of suitable sizes minimum 18"x18" shall be provided for access to all coils, dampers, controls, etc.; in insulated duct, door shall be double panel, insulated type and lockable.

2.06 FLEXIBLE CONNECTIONS

1. Flexible connections shall be provided to motorized equipment, made with at least 3" of neoprene coated fiberglass cloth with 1" slack material (except kitchen hood exhaust).

2.07 LOUVERS AND SCREENS

1. All louvers shall be 45 degree, 4" deep, drainable louvers. Blades shall be stationary with two (2) drainable gutters incorporated. Head/jamb frame shall be drainable and resist water penetration. Material shall be 0.081" extruded aluminum. Provide optional welded frame, bird/inset screen, as manufactured by Airolite Model K6844 or approved equal. Provide insulated blank off panel with 0.032" aluminum skin to match louver finish. Coordinate and provide necessary trim and attachment details.

2. Louver panels shall be continuous within the specified masonry openings. Coordinate required sizes, total depth, offset to new equipment, etc. with field conditions and necessary modifications, attachment methods, gaskets, etc. Seal perimeter so not to restrict louver drainage mechanism. Document and submit field verified and equipment coordinated louver specifics via shop drawing submittal. Finish shall be Owner/architect selected custom color (non-metallic and non- exotic) Kynar painted finish as required to match brick or Owners' color sample.

3. An aluminum painted screen (½ " mesh) in an aluminum frame shall be provided over the louver in such a way as to be easily removable for maintenance.

4. Where air intakes or relief discharges occur on roofs, prefabricated aluminum curbs (maximum height 12"; minimum height 4") shall be provided one inch higher than gravel stop or parapet scuppers and properly flashed. Aluminum rain hoods or goosenecks, unless otherwise shown, shall be provided thereon, so designed as to prevent rain entrance, provide low frictional resistance and have rigid construction, each provided with removable screen.

5. Where louvers have internal component and/or their associated dampers as indicated on drawings and/or specifications, all internal portions shall have a metal protective screen. Screen shall be constructed to allow for specified air flow.

6. Screen shall be of adequate size, dimension and configuration to allow for proper air flow and protection of internal components.

7. Provide hinged access for components requiring maintenance.

8. Screen shall be removable. Paint screen and all components color selected.

2.08 FAN DISCHARGE, BACK DRAFT AND RELIEF DAMPERS

1. Air/Dynamic as manufactured "Air Balance" or approved equal.

2.09 DUCT IDENTIFICATION

1. Provide for all concealed insulated and non-insulated duct and duct exposed in non-finished areas; self-adhesive color-coded labels for identification of air flow and equipment.

2. Markers shall be installed at every turn in direction and minimum every 25'.

3. Markers shall have color coding per the manufacturer. In addition to marking, the duct shall have flow directions located next to duct markers.

4. Flow directional tape shall be completely around all visible portions of duct and termination shall be 1' +/- past visible corner. Flow directional tape shall be ASME A13.1 color coding. Color to match duct markers. Arrows shall be white on green, red or blue and black on yellow, green or orange.

5. The duct shall have flow direction located next to flow direction. Indication shall be MS900 flow directional tape; 2" wide for duct up to 12' +/- AFF and 4" wide for duct above 12' +/- AFF.

6. Markers shall have color coding and lettering per the manufacturer and meet ASME A13.1 Standards.

7. Duct markers shall be; duct up to 12' +/- AFF – 2-1/4" x 13" and duct above 12' +/- AFF – 4" x 24".

8. Duct markers shall be MSI MS-900 or approved equal.

2.10 BOILER BREECHINGS (OWNER FURNISHED EQUIPMENT)

1. Boiler breeching shall be constructed of UL Listed Type AL-294-C stainless steel. Provide all hangers, supports and wall support roof penetrations.

2. Provide caps at top of stacks.

3. Provide all drip points for condensate piped thru condensate neutralizer to floor drains per boiler manufacturers' requirements.

4. Installation shall be in accordance with manufacturers' requirements. Contractor, as part of shop drawing submittal for flues, submit to boiler manufacturer for their review and approval.

2.11 GAS VENTS FOR DOMESTIC HOT WATER HEATER & GAS FURNACES (OWNER FURNISHED EQUIPMENT)

1. Provide 4" dia. PVC inlet and 4" dia. PVC discharge, connect to hot water heater. Provide wall/roof termination kit. Install per manufacturers' requirements.

PART 3 EXECUTION

3.01 AIR DELIVERY AND NOISE

1. This Contractor shall guarantee that all equipment shall operate without objectionable noise or vibration; that all ductwork shall be free from pulsation or objectionable noises; that the volume of air specified will be delivered to all points of supply and exhaust.

2. After this system is in operation, should the ductwork be found to vibrate or chatter, Contractor will be required to eliminate same.

3.02 TESTING OF AIR DISTRIBUTION SYSTEM

1. The volume and velocities of air at all terminals, outlets and inlets, shall be tested.

2. The volume dampers, splitters and deflectors shall be adjusted so that the air velocities and volume will be as specified.

3. See Specification Section 15010 "Start Up and Adjustments" and 15191 for balancing and testing.

3.03 DUCTWORK INSTALLATION

1. All ductwork shall generally be installed in the location and manner shown and detailed on the drawings with all fittings and connections made in accordance with the applicable SMACNA Manuals. Duct shown on drawings are diagrammatic. Contractor to determine in field exact routing, size and configuration. All modifications or deviations required by job conditions must be approved prior to any fabrication.

2. Prepare all ductwork and set it in place before furring begins. Extend all damper operators and serviceable or adjustable devices to accessible locations.

3. All connections from sheet metal assemblies such as ductwork, plenums, etc., to operating machines and/or mechanisms such as fans, air conditioners, etc., shall have flexible connections.

4. Where any ductwork is mounted lower than 7'-0" above a finished floor line, all seams in ducts shall be flattened and filed so that no standing seams or angle bracing protrudes from the duct in any manner which could cause injury to personnel. Covering of standing seams with an approved flexible bumper material, like split Armaflex pipe insulation or approved equal is acceptable.

5. Coordinate exact location of all duct in field with existing construction. Coordinate location of all duct with truss manufacturer.

6. All ductwork shall be delivered and sealed in accordance with SMACNA requirements and sealing shall only be removed prior to installing duct. After installation, duct shall still be protected from water damage.

7. All labels on exposed and concealed duct shall be removed.

3.04 ACOUSTICAL TREATMENT

1. Unless otherwise noted, all duct from all fans and units with fans to 20' from fans shall be acoustically insulated. Ducts to be acoustically insulated shall be insulation in the interior of the duct with 1" thick, 1-1/2# density fiberglass meeting ASTM C1071, coated with acrylic treated EPA registered anti-microbial agent proven to resist microbial growth as determined by ASTM G21 and G22, K value :25 at 75 deg. F., N.R.C. .65 or higher based on type A mounting and listed in accordance to ASTMC-423.

2. Rectangular duct shall be secured using full coverage water based adhesive meeting ASTM C916. Secure insulation with mechanical lines fasteners per SMACNA, NAIUI or manufacturers requirements. All exposed edges of the insulate shall be factory or field coated. Repair liner surfaces with adhesive. Insulate may be installed after duct fabricator at contractors option. Increase duct size to allow for insulation thickness.

3. Insulation shall be pasted to the metal surface with "3M" EC-890 or approved equal, before duct is made up. On large ducts, stick pins stud-welded or pasted shall be used as additional support. Insulation may be installed after duct is fabricated at Contractor's option.

4. Duct insulation and linings shall not glow, flame or smolder when tested at their rated temperatures in accordance with ASTM-C-411, test temperature 250° F. or greater. Duct liners shall be interrupted at fire damper and fire doors.

5. Where acoustical insulation is installed, exterior duct wrap is not required unless acoustical insulation does not meet the specifications for duct insulation R Values as indicated in Section 15180.

6. All acoustical insulation shall be plenum rated.

3.05 ROOF PENETRATIONS

1. All roof penetrations shall have roof curb minimum 12" high with cant strip, flashing collars, flashing and counterflashing.

2. Provide sloped roof curbs at sloped roofs. Verify all curbs with roof conditions prior to shop drawing submission.

3. All roof curbs shall be installed per SMACNA requirements.

4. Where re-roofing work requires higher curbs due to new insulation, these shall be used. Coordinate with general contractor for exact location.

5. Gooseneck terminations are <u>not</u> permitted.

3.06 AIR TIGHTNESS

1. All ductwork shall be airtight as defined by ASHRAE and SMACNA. All transverse, joints longitudinal seams and duct wall penetrations shall be sealed in accordance with ASHRAE 90.1 latest edition and have adhesive (3M EL-750 or approved equal). Pressure sensitive tape shall only be allowed for supply air duct with design pressures less than 2" W.C. in return air plenums.

3.07 FAN DUCT CONNECTION

1. All duct connections to fans and/or equipment with fans shall be installed in strict accordance with fan manufacturer's requirements. Ducts shall be installed to eliminate any system effects pressure losses. Where ducts are shown or are required to be installed that are not in compliance with manufacturers requirement, the additional pressure losses due to the system effect shall be added to the fans specified static pressure and fan size increased accordingly. All work shall be done at no additional cost.

2. Where elbows are required at discharge, they shall be full radius elbow R/W = 1.5 or greater.

3. All discharge dampers shall be arranged and installed in accordance with manufacturers' requirements and to avoid any system effects.

END OF SECTION
15860.6290

SECTION 15870 - TEMPERED AIR TERMINAL UNITS

PART 1 GENERAL

1.01 SCOPE

1. Furnish and install all air terminal devices in sizes, types and capacities shown on the drawings.

2. Removal, addition and/or modification of existing systems as indicated on plans.

3. Removal of existing air devices and replacement with new air devices as indicated on plans.

1.02 RATINGS

1. Manufacturer shall rate all terminals in accordance with Air Diffusion Council (where applicable).

PART 2 PRODUCTS

2.01 REGISTERS AND GRILLES

1. All supply air registers shall be METAL*AIRE Model V4004D-1 or approved equal consisting of two (2) banks of fins, front bank vertical, second bank horizontal, with one (1) bank of multi-opposed damper blades operated by a concealed screwdriver operator.

2. All return and exhaust air registers shall be consisting of one (1) bank of horizontal fins fixed at a 45-degree angle with one (1) bank of multi-opposed damper blades operated by a removable key.

3. Where grilles are shown, omit the damper.

4. All registers and grilles shall be of aluminum construction with baked white enamel finish.

5. For all registers or exposed duct; Titus Model 5300FL or approved equal.

6. Return air grilles open to ceiling return air plenum (Price Model RAC or approved equal.)

2.02 DIFFUSERS

1. All ceiling diffusers shall distribute air in a horizontal pattern parallel to the ceiling.

2. All diffusers shall be equipped with opposed blade dampers, operated from diffuser face by an unobtrusive screw operator.

3. All diffusers shall be perforated style METAL*AIR Model 7500-6 AF or approved equal for lay-in ceilings. Face size shall be 24"x24". All diffusers shall be steel construction with aluminum face plates. The finish shall be white baked enamel with black back pan and interiors.

PART 3 EXECUTION

3.01 INSTALLATION

1. All devices shall be mounted true and square, pulled up tightly without distortion.

2. Provide equalizing deflectors and/or air extractors where required to achieve proper air distribution.

3.02 FIRE RATED CONSTRUCTION

1. All devices in fire rated construction shall be provided with approved fire dampers, "tents", or other devices as required to conform to applicable regulations.

3.03 VISIBILITY

1. Where registers and grilles are at floor level and inside of duct is visible, provide acoustic insulation (black) or where insulation is not specified or required, paint all visible inside surfaces of duct flat black.

END OF SECTION
15870.6290

SECTION 15930 - FACILITY MANAGEMENT CONTROL SYSTEM

PART ONE – GENERAL

1.01 SCOPE

1. Provide a fully integrated Web Browser Control System incorporating Direct Digital Control (DDC) Technology with energy management, equipment monitoring, and remote communications for the systems for where new work is shown.

2. The Facility Management Control System (FMCS) shall be comprised of a network of interoperable, stand-alone digital controllers communicating on an open protocol network to the Individual Building Master Network controller. Access to the various Building Management Control Systems shall be locally from any computer or from the existing computer located in the building or remotely from any web access site and shall be accomplished through a Graphical User Interface using Web browser technology via the Internet.

3. The Facility Management and Control System (FMCS) as provided in this specification shall be based on a hierarchical architecture. Equivalent products must be approved in writing by the contractor per Specification Section 01300, "Submittals," Item 2.1 "Substitutions.".

4. The schools' Information Technology Department will provide IP drops for integration into the Information Technology System.

5. Connections to all equipment requiring connections to the control medium whether furnished under this Section or not.

6. The system shall us the latest technologies available from the manufacturer in the implementation of Direct Digital Electronic Control for the HVAC system and its management.

7. The systems shall be installed by factory trained technicians, regularly employed by the manufacturer and factory trained in the installation and calibration of the product.

8. This Contractor shall be responsible for all software data drops, programming, calibration, the proper operation and adjustment of all controls, dampers and appurtenances to provide required sequence of operations and protection against freeze-ups. Provide system in accordance with specifications.

9. All software, equipment, training and all work shall be of the same manufacturer and/or ATC sub-contractor. Independent ATC companies and/or contractors owned by or represented by, or in any manner associated with the specified manufacturers are not considered to be the specified manufacturer.

10. This Contractor shall provide all labor, material, equipment and software not specifically referred to herein or on the plans, that are required to meet the functional intent of the 15930 specifications and shall be provided without any additional cost to the Owner. This Contractor shall furnish all electrical control and interlock wiring connected to the controls and instrumentation systems. All 110 VAC or greater voltage power wiring to main control panels shall be provided by this contractor, unless indicated otherwise in the Contract Documents.

11. All materials and equipment used shall be standard components, regularly manufactured for this and/or other systems and shall not be custom designed especially for this project. All components shall have been thoroughly tested and proven in actual use.

12. This Contractor shall be responsible for installation of all field equipment and the communication transmission bus. This Contractor shall supply all necessary electrical power to each controller and provide transformers as required from electrical power panel source.

13. Provide system in accordance with specifications.

1.02 CONTROL CONTRACTOR

1. The Facility Management Control Systems shall be an extension of the existing control system presently installed. The control system hall be engineered, programmed and installed by Peterson Service Company, with no exceptions. Contact estimating@petersonservice.com.

1.03 WARRANTY

1. Provide the following warranties by the installing Automatic Temperature Controls (ATC) Manufacturer:

   A. Warranty on equipment.

   B. Warranty on software upgrades.

   C. Warranty on firmware upgrades.

2. Labor and materials for the control system specified shall be warranted free from defects for a period as indicated in "General Conditions". Control system failures during the warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to the Owner. This Contractor shall respond to the Owner's request for warranty service with 24 hours during normal business hours.

3. All work shall have a single warranty date.

4. The Owner shall grant to the temperature control subcontractor reasonable access to the FMCS during the warranty period. The owner shall allow the contractor to access the FMCS from a remote location for the purpose of diagnostics and troubleshooting, via the Internet, during the warranty period.

1.04 MAINTENANCE SERVICE

1. In addition to warranty periods per the General Conditions, provide maintenance service per Specification section 15010, Part 1.11.

2. The base contract shall include a 2-year service/maintenance term in addition to the 2-year bonded General Contract warranty. The 2-year controls services shall include:

   A. **Daily trending:** and logging remotely from the controls' provider remote from the building. A sampling of rooms as agreed by the owner include at least 20% of the rooms shall be trended to confirm proper temperature ranges are maintained.

   B. Daily **alarm monitoring.** The alarm reports shall be monitored remotely, and all alarm issues need to be addressed daily. The weekly report must summarize the alarm issues.

C. The trending shall be summarized in a **weekly email report** to the owner. All rooms outside of the temperature and proper operating ranges shall be highlighted in the report.

D. The weekly email report shall be discussed in a pre-set time **conference call** that occurs every week.

E. Once a month, a project specific technician shall **meet onsite** with Owner to review the weekly reports. The meeting onsite shall be a minimum of 4 hours with onsite verification, tweaking, calibrating and replacing necessary parts and operations as required to maintain the system.

F. Continued **Owner training** over the 2-year term of 40 hours.

1.06 QUALITY ASSURANCE

1. All system components shall be fault tolerant and provide satisfactory operation without damage at 110% and 85% of rated voltage and at + 3 hertz variation in line frequency.

2. Provide static, transient, and short circuit protection on all inputs and outputs. Communication lines shall be protected against incorrect wiring, static transients and induced magnetic interface. All bus connected devices shall be a.c. coupled or equivalent so that any single device failure will not disrupt or halt equipment operation.

3. The Manufacturer of the Facility Management Control System shall provide documentation supporting compliance with ISO-9002 (Model for Quality Assurance in Design/Development, Production, Installation and Servicing). The intent of this specification requirement is to assure that the products from the Temperature Control System Manufacturer are delivered through a Quality System and Framework that will assure consistent quality in the products delivered for this project.

4. Product literature provided by the Building Management Control System Manufacturer in the submittal package shall contain the ISO-9002 Certification Mark from the applicable registrar.

1.07 TRAINING

1. All training materials shall be by the FMCS manufacturer and shall utilize specified manuals, as-built documentation, and the on-line help utility

2. Operator training shall include ten (10) separate 8-hour sessions (times per Owner) encompassing:
   - Sequence of Operation review.
   - Sign on-Sign off
   - Selection of all displays and reports.
   - Commanding of points, keyboard and mouse mode.
   - Modifying English text.
   - Use of all dialog boxes and menus.
   - Modifying alarm limits and start-stop times.
   - System initialization.
   - Download and initialization of remote controllers.
   - Purge and/or dump of historical data.

- Troubleshooting of sensors (determining bad sensors).
- Password modification.

1.08 SUBMITTALS

1. Shop drawings and Product Data: Submit under provisions of General Conditions, shop drawings.

2. Product Data: Catalog sheets, specifications, control/wiring, schematic drawings, installation instructions for each item furnished. Include the valve and damper schedules and communications layout of DDC Control System.

3. Shop Drawings:

   A. List of connected data points, including connected control unit and input device.

   B. System graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations.

   C. System configuration with peripheral devices, batteries, power supplies, diagrams, modems and interconnections.

   D. Descriptive data and sequence of operation of operating, user and application software including Web Browser software/hardware integrations.

   E. Flow charts showing the logic sequence for each panel. Provide a non-jargon description for each step in the sequence. In addition, identify which variables are built into the system programming, and which have variable names and can be changed by the operator(s) from the Central Processing Unit.

4. Maintenance Data and Operation Instructions: Upon completion of the work and prior to final acceptance, provide copies of "Systems Operation and Maintenance Manuals" for the installed control systems. Manuals shall consist of copies of all temperature control submittals, including schematic diagrams, panel drawings, components parts, Web Browser Networks, accessories, operation and maintenance instructions, recommended spare parts inventory and complete warranty information.

I.09 SYSTEM DESCRIPTION

1. This specification defines the minimum equipment and performance requirements for a complete Facility Management Control System for the listed buildings HVAC/Mechanical Systems including terminal equipment.

2. It shall be understood that the drawings and specifications describe the approximate locations of the work. Do not scale the drawings to determine exact positions and clearances.

3. Details of construction and of workmanship where not specifically described herein or indicated on the drawings shall be subject to review by the school district. It is the intent of these specifications to provide a complete system, left in good working order, ready for operation, including necessary labor and materials, whether or not specifically shown on the drawings or mentioned herein.

4. Before submitting proposals, examine the specifications and all drawings relating to the work and become fully informed as to the extent and character of the work and the relation of the work to that of other Sections. Examine the drawings of other Buildings Control Systems to become familiar with all the problems and details of the building construction.

5. Automatic temperature control field monitoring and control system using field programmable micro-processor-based units with web browser communications are the intent of this design.

6. Central and remote hardware, software, and interconnecting wire and conduit. User access to new control system shall be from new web browser network.

7. Entire system is to be installed by the System Manufacturer or factory authorized representative.

8. The installation shall comply with local, state, and federal code requirements as applicable.

9. This contract also includes the creation of Systems Graphics at the new FMCS front end computer. The Graphics Programming includes Graphics Creation and Dynamic Point editing to reflect all HVAC systems and Hardware System points specified in Part 4.

1.10 REPLACEMENT OF EXISTING SYSTEMS & CONTROLS

1. Existing equipment that is shown to remain shall have existing controls removed and new controls installed. The new controls installed shall include all wiring, new sensors, new controller, new control valves, new automatic dampers, new control sequences and all appurtenances to provide full integration, monitoring and control for all new equipment. The new controls shall be an extension of the existing system.

PART 2 PRODUCTS

2.01 STANDALONE DIGITAL CONTROLLERS (SDC)

1. The SDC controllers shall permit the simultaneous operation of all control, communication facilities management and operator interface software, as programmed by the Contractor or User.

2. SDC controllers shall utilize true floating-point arithmetic capabilities for values within the range of +/-10 to the 10^{th} power. The SDC shall employ a multitasking, multi-user operating system.

3. All programming defining the functions to be performed by the SDC.

4. SDC controllers shall be equipped with a minimum of two operator service ports for the connection of serial devices such as the GP, HMI, modems, printers, etc. The SDC shall be able to route alarms, trends, and reports to any serial device connected to the network and dialing out to a minimum of ten remote locations.

5. The SDC shall provide Alarming, point trending and Energy report generation capabilities.

6. Each unique trend report shall contain a minimum of 4 different points and a minimum of 128 samples per point. Trend reports shall be internally formatted by the SDC be reportable directly to a serial printer, a display terminal or any other device capable.

7. The energy reports shall not be limited in quantities only by available memory within the GDC.

8. The SDC controller shall provide a built-in operator interface and a multi-function keyboard.

9. The SDC shall provide for logical grouping of network variables and allow for viewing and editing of system parameters.

10. The SDC shall provide connectivity to the currently marketed FMCS solutions offered by the manufacturer. The SDC shall be interoperable with these FMCS offerings for scheduling, global data sharing, energy demand limiting, alarming, optimized start/stop, and systems integrations for all other data within the entire FMCS. In addition, the SDC shall provide connectivity to existing DDC controllers currently marketed by the manufacturer.

2.02 GRAPHICAL USER INTERFACE (GUI)

1. The Graphical User Interface shall reside on the communication bus to allow the operator to view, configure, and edit values from multiple controllers on the bus. The GUI shall be completely programmable using standard user-definable graphical icons associated with any displayed variable. Variables such as alarms, trends, setpoints, analog, and digital values may be displayed and/or edited using the GUI.

2. Multiple GUIs shall be capable of residing on the LAN and shall be capable of displaying common and/or unique parameters of the system controllers. The GUI shall be menu based displaying a minimum of 16 menus, and 256 unique system parameters.

2.03 GRAPHICAL USER INTERFACE SOFTWARE

Where new software is required, it shall be as specified below.

1. Operating System:

   A. The GUI shall run on Microsoft Windows NT Workstation 4.0, Service Pack 4 or later.

2. The GUI shall employ browser-like functionality for ease of navigation. Include a tree view, menu-pull downs, and toolbars shall employ buttons, commands and navigation.

3. Real-Time Displays - The GUI, shall at a minimum, support the following graphical features and functions:

   A. Graphic screens shall be developed using any drawing package capable of generating a GIF, BMP, or JPG file format. In addition to, or in lieu of a graphic background, the GUI shall support the use of scanned pictures.

   B. Graphic screens shall have the capability to contain objects for text, real-time values, animation, color spectrum objects, logs, graphs, HTML or XML document links, schedule objects.

   C. Graphics shall support layering and each graphic object shall be configurable for assignment to a layer. A minimum of six layers shall be supported.

   D. Modification of common application objects, such as schedules, calendars, and set points shall be accomplished in a graphical manner. Schedule times will be adjusted using a graphical slider. Holidays shall be set by using a graphical calendar.

E. Commands to start and stop binary objects shall be done by selecting the appropriate command from the pop-up menu.

F. Adjustments to analog objects, such as set points, with a graphical slider to adjust the value.

4. System Configuration. At a minimum, the GUI shall permit the operator to perform the following tasks, with proper password access:

- Create, delete or modify control strategies.
- Add/delete objects to the system.
- Tune control loops through the adjustment of control loop parameters.
- Enable or disable control strategies.
- Generate hard copy records or control strategies on a printer.
- Select points to be alarmable and define the alarm state.
- Select points to be trended over a period of time and initiate the recording of values automatically.

5. On-Line Help - Provide a context sensitive, on-line help system to assist the operator in operation and editing of the system.

6. Security - Each operator shall be required to log on to that system with a username and password in order to view, edit, add, or delete data. System security shall be selectable for each operator.

7. System Diagnostics - The system shall automatically monitor the operation of all workstations, printers, modems, network connections, building management panels, and controllers. The failure of any device shall be annunciated to the operator.

8. Alarm Console

A. The system shall be provided with a dedicated alarm window or console. When enabled, a separate alarm notification window will supersede all other windows This window will notify the operator of new alarms and un-acknowledged alarms.

9. Web Browser

A. The system shall use a standard web browser such as Internet Explorer™ or Netscape Navigator™. Software shall run on any operating system that is supported by the web browser.

B. The web browser shall provide the same view of the system as provided by the Graphical User Interface.

C. The web browser client shall support at a minimum, the following functions:

1. User log-on identification and password.

2. Graphical screens developed for the GUI shall be the same screens used for the web browser client.

3. HTML programming shall not be required to display system graphics or data on a web page.

4. Real-time values displayed on a web page shall update automatically without requiring a manual "refresh" of the web page.

5. Users shall have administrator-defined access privileges to modify common application objects. Adjust schedule times and set holidays.

    a. Commands to start and stop binary shall be by selecting the appropriate command from the pop-up menu.

    b. View logs and charts

    c. View and acknowledge alarms

2.04 PROTECTIVE FREEZESTATS, FIRESTATS AND SMOKE DETECTORS

1. New rooftop unit shall have freezestat located on the suction side of the fan where hot water heating is included. The new units shall be interfaced with existing. When its setting is exceeded, perform the following:

    A. Open control valve on heating coil to full heating and/or close outside air damper and stop fans.

    B. All protective devices shall be manually reset and shall send an alarm signal to DDC system.

2. Existing systems shall have existing smoke detector in system greater than 2,000 cfm installed in return downstream of filters.

3. Existing smoke detector well, interlock, control wiring and all appurtenances shall be by user.

4. Upon activation, the existing smoke detectors shall shut down the new air distribution system.

5. Where new smoke detectors are required, they shall be supplied by electrical contractor and wired to existing fire alarm panel by electrical contractor. New smoke detectors shall be installed by HVAC contractor.

6. The electrical contractor shall verify smoke detector auxiliary contacts.

7. The interlocking of smoke detectors with HVAC equipment shall be by this Contractor.

2.05 CONTROL

1. Temperature, relative humidity and pressure transmitters shall be direct acting instruments capable of transmitting an electronic signal in direct proportion of the medium change.

2. All controls that are exposed to the outdoor elements shall be mounted in weatherproof boxes. These boxes will in no way interfere with the operation or sensing of these controls.

3. All controllers shall be externally mounted on indoor units (none in finished spaces). Controller mounted in finished areas shall be internally mounted in equipment and have access doors.

PART 3 EXECUTION

3.01 ELECTRIC WIRING

1. All power and control wiring in connection with the temperature control system shall be furnished and installed under this contract and shall be per applicable NEC.

2. All electrical controls and switches shall be suitable either for 120 volts, 60 Hz or 24 VAC.

3. For control circuits of 115 volts and above, all wire shall be rated for 600 volts and may be either single or multi-conductor cable.

4. For control circuits below 30 volts, all wire shall be rated for 300 volts and may be either single or multi-conductor cable.

5. All electrical sensing element wire shall be in accordance with manufacturers' recommendation with the proper number of conductors, equivalent to Beldon No. 8770 and installed in "EMT" conduit in mechanical room. This cable shall not be installed in the same conduit with any conductors for voltages of 115 or above.

6. Electrical work provided shall include, but not limited to:

   A. Wiring from all control devices furnished to the respective equipment being controlled.

   B. Furnishing and installation of all necessary conduit and wire.

   C. Interlocking wiring between rooftop units, exhaust fans and radiation as specified in the sequence of operations, shown on the drawings or otherwise required.

   D. Installation of smoke detectors by the mechanical contractor and wiring to fan starter by the FMCS contractor.

   E. Wiring of flow switches, sequence relays, thermostats and permissive circuits to boilers.

7. Metal raceways shall be installed where pipe cannot be installed in construction and shall be stamped one-piece metal minimum 18-gauge, factory painted color selected and secured to prevent vandalism.

8. In locations where wire cannot be installed above ceiling, wire shall be run in metal raceways.

9. Except for motor feeders and for existing wiring between motors, motor controllers, feeder panels, fuses, circuits breakers and buss bars, all of the new electrical work required for the facility management control system including but not limited to time switches, damper motors, damper switches, electric thermostats, electric relays, interlocking wiring, wire, conduit, etc. shall be provided and installed by the FMCS Contractor. It shall be the FMCS Contractor's responsibility to provide all wiring required to achieve the functions called for in these specifications.

10. All exposed wiring shall be in EMT or rigid conduit.

11. Control wiring in plenums shall be furnished and installed in EMT or conduit or an approved shielded cable for plenum use.

3.02 ROOM SENSORS

1. Sensors shall be located so that they will not be influenced by the mechanical system or heat producing equipment. Sensors installed not in accordance with above shall be relocated and construction repaired at no additional cost to Owner.

2. Mount all sensors as required by ADA unless otherwise directed or required by code.

3. The exact location of sensors and/or thermostats to be determined in field with Owner and be coordinated with the final furniture layout. Submit location for review with shop drawings.

4. As part of bid, Contractor to include sufficient wire to relocate sensor 10'± from location shown and where interference occurs, sensors shall be relocated (after final installation) at no additional cost to Owner. This shall be for all sensors.

5. Where sensors are shown to be located behind grilles, provide hinged access and mark location.

3.03 DRAWINGS AND LAYOUT

1. This Contractor shall provide diagrams of the automatic temperature control system, which shall show all control equipment and the function of each item.

2. The following data/information shall be submitted in accordance with General Conditions;

   - Complete sequence of operation.
   - Color coded control system CAD generated drawings including all pertinent data to provide a functional operating system.
   - Valve and damper schedules showing size, configuration, pressure losses, capacity and location of all equipment.
   - A description of the installation materials including conduit, wire flex, etc.

3.04 EQUIPMENT CONTROLS

1. All controls required and/or specified to be installed by the DDC contractor in equipment to be furnished under this contract except those control normally provided by the equipment manufacturer, shall be sent to the equipment manufacturer and be factory installed.

2. The controls may be field assembled by DDC contractor. However, this Contractor shall assume all responsibility for proper operation of the mechanical equipment and coordination of the work.

3. When controls, dampers, valves, etc., are mounted in equipment furnished by others, the DDC contractor shall provide all required electric wiring and appurtenances and include connection to the equipment as required for system to function as specified.
4. Where controls are to be field installed and controls are not factory installed and wired, the following is a recommended interface.

   A. The HVAC equipment suppliers shall provide a terminal strip in the control compartment of their equipment to allow their equipment to provide the specified sequence.

Economizer Control - The HVAC equipment shall accept a single 0-10-volt signal from the DDC system to modulate the outdoor air, return air, and relief air dampers. The dampers and actuators are to be provided by the HVAC equipment supplier and the damper actuators are to be spring return. The damper actuators shall be powered from the HVAC equipment and wired at the factory. A 0-volt signal shall make the outdoor and relief dampers fully closed and the return damper fully open.

Note - At contractors' option, alternate methods of interface may be used; submit for review.

5. It is the intent of these specifications that the controllers for rooftop units be located either in rooftop units or remotely located. Controllers for equipment other than rooftop units and controllers for rooftop units not installed in units shall be located as specified below.

   A. All unitary controllers shall be located as close to units they service. Controllers may be located above ceiling, except where there is no ceiling or where equipment is located in close proximity to normally unoccupied spaces (storage rooms, janitor closets, electric rooms, etc.) For these areas, controllers shall be located as high as practical below ceiling on walls. All controllers shall be accessible and clearly marked by permanent color-coded indicators on ceiling.

6. VAV air device controls shall be shipped to the VAV manufacturer for factory mounting, see Specification Section 15870.

3.05 INSTALLATION OF VALVES AND DAMPER MOTORS

1. All control valves and damper motors shall be furnished by temperature control manufacturer and installed by this Contractor or manufacturer of equipment in whose work it is to be mounted, regardless of who furnished equipment.

2. Where damper motors are provided by equipment manufacturer, they shall be completely integrated with the DDC system. The contractor is responsible for all coordination of work not in accordance with above at no extra cost to Owner.

3.06 VALVE, DAMPER AND CONTROL DEVICE LOCATION AND ACCESSIBILITY

1. All control equipment requiring service or adjustment located above suspended acoustical ceiling shall have their locations permanently marked on ceiling. Markings shall consist of a color scheme. The markings shall be permanently applied to surface with legend and location agreed to and provided to Owner. Provide in addition to chart, a permanently mounted graphic display as to locations of the devices.

2. All devices shall be located to be accessible and easily maintained and if found inaccessible, shall be relocated by this Contractor at no additional expense to Owner, regardless of the trades involved.

3. Where devices are behind general construction, provide access doors.

3.07 ATC PANELS

1. The location and quantity of ATC panels are to be determined and verified in field. Panels to have emergency power electrical connections. The final location and quantity of panels are to be

verified with Owner. This Contractor shall be responsible to coordinate all power wiring requirements as to location, quantity, and wire size with electrical contractor. Extension of services, new power wiring for additional panels, and all modifications to panels which affect electrical contractor shall be the responsibility of the ATC contractor.

2. All DDC panels, controllers, and equipment that require continuous uninterrupted power supply are to remain in operation and shall have battery and/or UPS back-up provided by this Contractor. The back-up shall be for a minimum of 3 hours and shall allow for an orderly shutdown. The resetting, rescheduling, and/or reprogramming of the controls will not be allowed; based upon failure to meet the intent of this specification.

3. No unit controllers or DDC panels shall be located above the ceiling.

3.08 ECONOMIZERS

1. All economizers shall be enthalpy type for rooftop units.

3.09 CO2 SENSORS

1. Where indicated on plans or specified for all units with field-installed controls and shall meet all sections of specifications and provide CO2 sensors. Where units are specified to be packaged, the unit manufacturer shall meet all sections of the specification, including the Sequence of Operation.

2. CO2 sensors are to be located in return air path and are to modulate outside air dampers.

3.10 ACCEPTANCE TESTING

1. Upon completion of the installation, this Contractor shall load all system software and start-up the system. This Contractor shall perform all necessary calibration, testing and de-bugging and perform all required operational checks to ensure that the system is functioning in full accordance with these specifications.

2. This Contractor shall perform tests to verify proper performance of components, routines, and points. Repeat tests until proper performance results. This testing shall include a point-by-point log to validate 100% of the input and output points of the DDC system operation.

3. Upon completion of the performance tests described above, repeat these tests, point by point as described in the validation log above in presence of Owner's representative, as required. Properly schedule these tests so testing is complete at a time directed by the Owners' representative. Do not delay tests so as to prevent delay of occupancy permits or building occupancy.

4. System Acceptance: Satisfactory completion is when this Contractor has performed successfully all the required testing to show performance compliance with the requirements of the contract documents to the satisfaction of the Owners' representative. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

5. Any found defective existing mechanical equipment and/or control devices (examples; control valves, freezestats, temperature sensors, actuators, CO2 sensors, humidity sensors, etc.) are to be listed and reported to Engineer and Owner.

3.11 ROOFTOP UNIT DEHUMIDIFICATION CYCLE

1. Upon a rise above setpoint of room humidistat and unit in cooling occupied mode; energize units' hot gas reheat cycle and close outside air damper. Whenever outside relative humidity is higher than inside outside, air damper shall remain closed for minimum of 1 hour. After that time, CO2 sensor shall allow damper to be cycled between open and closed based on indoor humidity. Upon a continued rise above space humidity sensor and a fall below space temperature and hot water is available; modulate hot water valve heat coil to maintain room temperature. Upon a rise above setpoint, the reverse shall occur.

PART 4 HARDWARE POINTS

1. Packaged Rooftop Unit

   - Supply Fan Start/Stop
   - Alarm State
   - Supply Fan Status
   - Outside Air Temperature
   - Discharge Air Temperature
   - Space Temperature
   - Space Setpoint
   - Return CO_2 (U.N.O. setpoint to be 700 PPM above ambient)
   - Economizer Command
   - Heating Valve Enable Command (Where applicable, FMCS contractor to provide control based on RTU controller heat command/enable, modulation of ATC valve by FMCS contractor.)
   - Freezestat tripped Alarm (where applicable)
   - Return Air Smoke Detector (for units indicated on plans)

2. Exhaust, Supply & Transfer Fans

   - Fan Start/Stop
   - Supply Fan Status - Current Transducer
   - Automatic Damper Operation (where applicable)
   - Room Temperature Setting (where applicable for ventilation)

3. Cabinet Unit Heater / Unit Heater (CUH, UH)

   - Fan Start/Stop
   - Supply Fan Status - Current Transducer
   - Valve Command – Modulating (where applicable, otherwise 2-Way valve command)

PART 5 SEQUENCE OF OPERATIONS

Sequence of operations are typical for all equipment of the type identified.

SPACE SETPOINTS

	SPACE SETPOINT
Occupied Heating	68°F.
Morning Warm-up	68°F.
Unoccupied Heating	60°F.
Occupied Cooling	74°F.
Cool-down	74°F.
Unoccupied Cooling	80°F.
Relative Humidity	55% RH

Note: All setpoints to be adjustable by Owner via FMCS.

OCCUPIED/UNOCCUPIED PERIODS

The purpose of this schedule is to establish a base line for equipment operation and sequencing. This is to allow system to provide optimum effectiveness and increase efficiency. The hours of operation shall be reviewed with the school prior to occupancy. The contractor shall provide as part of their training, instructions to Owner for changing and adjusting sequences and times of operation. The hours of operation shall also be able to be adjusted for individual equipment and/or zones.

Occupied Heating 6AM

Optimal start-up with adjustment based on system requirements.

Occupied Heating (Outside Air)

Operation of outside air system; damper open, outside air and heat recovery where applicable delayed approximately one hour after occupancy (adj.) and one hour prior to end of school (adj.).

Unoccupied Heating 3PM

Schedule for after school usage shall adjust this period.

Occupied Cooling 7AM

Optimal smart start-up with adjustment based on system requirements.

Occupied Cooling (Outside Air)

Operation of outside air system; outside air damper open and heat recovery where applicable delayed approximately one hour after occupancy (adj.) and one hour prior to end of school (adj.). In addition, where CO2 sensor below operational setpoint and outside relative humidity is higher, adjust damper opening time to allow for delayed opening.

Unoccupied Cooling 3PM

Schedule for after school usage shall adjust this period.

5.01 FANS

1. Ventilation Fans - Provide room thermostat to energize fan whenever its setting is exceeded and open automatic damper on intake (where applicable).

5.02 PACKAGED AIR CONDITIONING UNIT

1. The units shall be sequenced from occupied/unoccupied warm-up modes and cool-down modes from DDC system.

2. Note – Where units are specified to have air volume reduction or single zone VAV, provide all controls and integration with units' refrigeration control to capacity reduction based on reduced air flow.

3. Occupied Cycle Heating - When indexed to occupied cycle and room sensor requires heat; outside air damper to be under control of CO2 sensor which shall open outside air damper from closed to minimum position, return air damper open, energize associated exhaust fans and energize unit, and then modulate hot water heat valve on heat coil.

4. Occupied Cycle Cooling - When indexed to occupied cycle and room sensor requires cooling; energize associated exhaust fans, energize unit fan and allow operation of outside air damper from $C0_2$ sensor. Unit mounted integrated enthalpy economizer shall modulate outside and relief air dampers and return air damper as required to provide free cooling during economizer mode. Upon a further rise in space temperature, close outside air damper to minimum position, return air damper to maximum, energize refrigeration in steps.

5. Unoccupied Cycle Heating - When indexed to unoccupied cycle; all exhaust fans de-energized, outside air damper closed, the unit heater shall be 1st stage and then energize unit fan, modulate hot water control valve for duct mounted heating coil.

6. Morning Warm-Up or Cool-Down - When indexed to morning warm-up or cool-down from central control; unit to run, all exhaust fans de-energized, all outside and relief air dampers closed; first operate unit heater and then modulate hot water control valve for duct mounted heating coil until morning warm-up sensor is satisfied, at which time system reverts to normal occupied mode.

7. Provide room humidistat which, upon a rise above its setpoint (in cooling mode), energize units' dehumidification hot gas refrigeration to provide humidity control. Dehumidification sequence to be by the unit manufacturers' control. Provide sequence to have the unit energized for cooling with outside air dampers closed, modulate hot water control valve to maintain temperature (if hot water is available).

8. Cooling Unoccupied Mode - When indexed to unoccupied mode by central computer or manual override. All associated exhaust fans to be de-energized, relief and outside air dampers closed. Upon a rise above night sensor, unoccupied cooling space temperature as sensed by ATC system, external zone sensors and interior enthalpy is above outside exterior enthalpy, energize unit

economizer system 100% outside air and 100% exhaust air to provide purge mode. Provide time delay minimum 30-minute run time. Provide space low limit temperature and space high relative humidity thru DDC system shall override purge mode upon a fall below or rise above setpoints.

END OF SECTION
15930.6290

APPENDIX A

ITEM # 1

NCB-H High-Efficiency Condensing Combination Boiler

Submittal Sheet

- ☐ ***Model NCB-190/060H (60,000 Btu/hr. space heating and 160,000 Btu/hr. DHW)***
- ☑ ***Model NCB-190/080H (80,000 Btu/hr. space heating and 160,000 Btu/hr. DHW)***
- ☐ ***Model NCB-240/110H (110,000 Btu/hr. space heating and 199,900 Btu/hr. DHW)***
- ☐ ***Model NCB-240/130H (130,000 Btu/hr. space heating and 199,900 Btu/hr. DHW)***
- ☐ ***Model NCB-250/150H (150,000 Btu/hr. space heating and 210,000 Btu/hr. DHW)***

Job Name: _____

Location: _____

Engineer: _____

Wholesaler: _____

Sales Rep: _____

Contractor: _____

Model: _____ **Gas Type (NG/LP):** _____

Notes: _____

Boiler Standard Features

- SS Dual Heat Exchangers
- Cold-rolled Carbon Steel Casing
- 95% AFUE
- DHW 15:1 TDR
- Heating up to 11:1 TDR
- 30 PSI ASME Relief Valve
- Direct Spark Ignition
- Variable Speed Blower
- Dual Venturi Mixing System
- Negative Pressure Gas Valve
- Cascaded with up to 15 NPEs
- Common Vented with up to 7 NPEs
- Wall Mounting Bracket
- High Altitude NG and LPG Conversion Kits
- Outlet & Inlet Temp Sensors
- Outdoor Temperature Sensor
- Flue gas Temperature Sensor
- Condensate Trap
- Mixing and Water Adjustment Valves

Boiler Optional Accessories

- SS Primary Manifold Kit
- Condensate Neutralizer Kit
- Zone Controller
- Universal Temperature Sensor
- NaviLink Control System
- Ready-Link Racking System
- NaviClean Magnetic Filter
- NaviCirc for Recirculation
- HotButton and Wall Plate

Venting

- Direct Exhaust Sidewall or Roof Vent
- Direct Exhaust Inside Air Venting
- 2" PVC, CPVC, PP, SS up to 65 ft.
- 3" PVC, CPVC, PP, SS up to 150 ft.
- Vent Termination Caps
- Wall Flanges

Controls

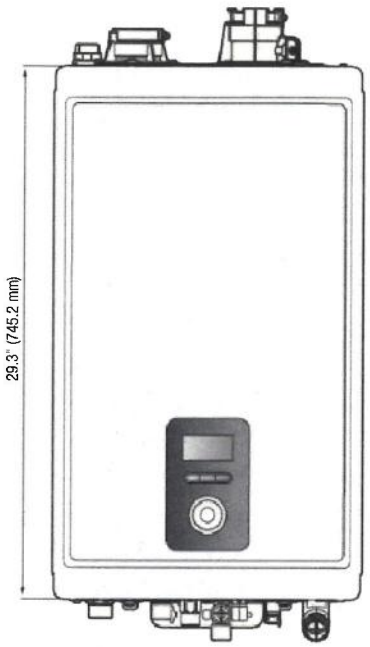
- Smart Controls with LCD Display, Quick Dial Wheel and Setup Wizard
- Built-in 3 zone pumps and 3 zone valves powered connections
- Manual Reset LWCO
- Manual Reset High Limit
- Freeze Protection
- Outdoor Reset
- Warm Weather Shutdown
- Air Handler Interface
- 4 Circulator Outputs
- NaviLink Mobile Application

Warranties

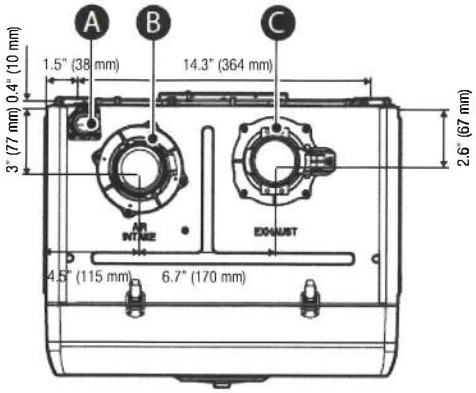
- 10 yrs. Residential HX Warranty
- 5 yrs. Residential Parts Warranty
- 1 yr. Labor Warranty

20 Goodyear, Irvine, CA 92618 T 949.420.0420 F 949.420.0430 W Navieninc.com

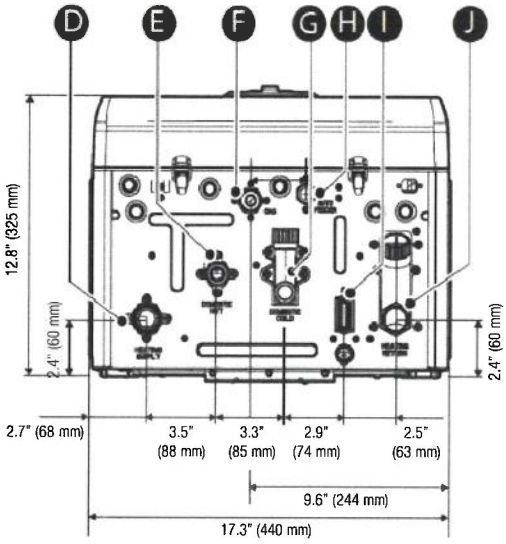
ITEM # 1



Overhead View



Supply Connections



Supply Connections

	Description	Diameter
A	Pressure Relief Valve Adapter	¾ in
B	Air Intake	2 in
C	Exhaust Gas Vent	2 in
D	Heating Supply	1 in
E	Domestic Hot	¾ in
F	Gas Connection	¾ in
G	Domestic Cold	¾ in
H	Auto Feeder Inlet (Make-up Water)	½ in
I	Condensate Outlet	½ in
J	Heating Return	1 in

Navien Combination Boiler Domestic Hot Water Ratings			Other Specifications				
Model Number	Heating Input (BTU/H) Min	Heating Input (BTU/H) Max	Water Pressure	Minimum Flow Rate	Flow Rate 77°F (43°C) Temp Rise	DHW Supply Connection Size	DHW Return Connection Size
NCB-190/060H	10,700	160,000	15-150 PSI	0.5 GPM (1.9 L/m)	3.7 GPM (14.0 L/m)	3/4" NPT	3/4" NPT
NCB-190/080H	10,700	160,000					
NCB-240/110H	13,300	199,900			4.7 GPM (17.8 L/m)		
NCB-240/130H	13,300	199,900					
NCB-250/150H	14,000	210,000			4.9 GPM (18.5 L/m)		

Navien Condensing Boiler Space Heating Ratings						Other Specifications		
Model Number	Heating Input (BTU/H) Min	Heating Input (BTU/H) Max	Heating Capacity (MBH)	Net AHRI Rating Water (MBH)	AFUE (%)	Water Pressure	Water Connection Size (Supply, Return)	Water Volume
NCB-190/060H	11	60	56	49	95.0	12 - 30 psi	1" NPT	1.5 gallons
NCB-190/080H	11	80	74	64	95.0			
NCB-240/110H	13	110	102	89	95.0			
NCB-240/130H	13	130	120	104	95.0			
NCB-250/150H	14	150	138	120	95.0			

ITEM # 2

SERIES XPV

Gas Fired, Power/Direct Vent, Cast Iron Water Boiler

- 85% AFUE
- 70 – 245 MBH (Induced draft, 6 sizes)
- Power vented (using indoor combustion air), optional direct vent kit (using outdoor sealed combustion air)
- Perfect for installations with unusable chimneys
- Separate factory builds for gas/LP and high altitude (in both fuels)
  - Get the boiler that's right for you!
- Includes supply line manifold with relief valve and T/P gauge connections
- Integrated boiler control with diagnositcs
  - FREE additional pump relay
  - Integral LWCO included, requires no piping! (IDL-1200)
- American-made cast iron heat exchanger
- Lifetime limited warranty
- Made in Lancaster, PA, USA

U.S. Boiler Company

X-PV: Technical Information

ITEM # 2

X-PV Ratings & Models

Model	Fuel	Input[1] (MBH)	DOE Heating Capacity (MBH)	Net AHRI Rating Water[1] (MBH)	AFUE%	Factory Builds "Order by Altitude"	
						Sea level to 2,000 ft.	2,000 to 10,000 ft.
X-PV3N	Nat. Gas	70	60	52	85.0	X-PV3N-T02	X-PV3N-T10
X-PV3P	LP	63	54	47	85.0	X-PV3P-T02	X-PV3P-T10
X-PV4N	Nat. Gas	105	90	78	85.0	X-PV4N-T02	X-PV4N-T10
X-PV4P	LP	94.5	81	70	85.0	X-PV4P-T02	X-PV4P-T10
X-PV5N	Nat. Gas	140	120	104	85.0	X-PV5N-T02	X-PV5N-T10
X-PV5P	LP	126	108	94	85.0	X-PV5P-T02	X-PV5P-T10
X-PV6N	Nat. Gas	175	150	130	85.0	X-PV6N-T02	X-PV6N-T10
X-PV6P	LP	157.5	135	117	85.0	X-PV6P-T02	X-PV6P-T10
X-PV7N	Nat Gas	210	179	156	85.0	X-PV7N-T02	X-PV7N-T10
X-PV7P	LP	189	161	140	85.0	X-PV7P-T02	X-PV7P-T10
X-PV8N	Nat. Gas	245	208	181	84.0	X-PV8N-T02	X-PV8N-T10
X-PV8P	LP	220.5	187	163	84.0	X-PV8P-T02	X-PV8P-T10

Maximum Allowable Working Pressure 50 PSI. Boiler shipped from factory with a 30 PSI safety relief valve.

(1) Input ratings can be used for elevations up to 2000 ft. above sea level. Refer to Appendix B of Operating and Service Instructions for elevations 2000 ft. and higher.

(2) Net AHRI Water Ratings shown are based on a piping and pickup allowance of 1.15. Consult manufacturer before selecting boiler for installations having unusual piping and pickup requirements, such as intermittent operation, extensive piping systems, etc.

Horizontal or vertical AL29-4C® stainless steel is required to vent the X-PV boiler

Standard Equipment

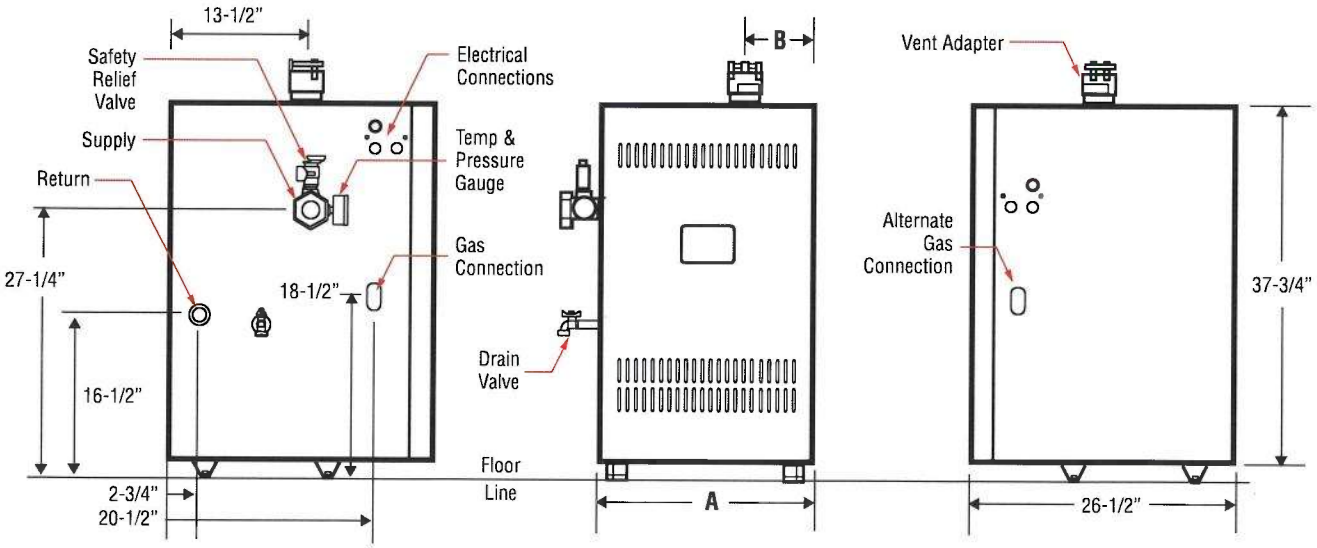
- Cast iron section assembly with metal push nipples
- Insulated steel jacket
- 1" base insulation
- Intelligent Hydronic Control – simple self-diagnostic control system with 3-digit readout for status settings and errors
- Step-opening redundant gas valve
- Stainless steel burner tubes
- Stainless steel flue gas baffles
- Spark ignition with continuous retry
- Taco ECM circulator included
- Pre-installed IDL-1200 LWCO
- Air pressure switch
- Boiler drain valve
- Cast iron supply manifold with safety relief valve tapping

X-PV Dimensions, Specifications, Optional Conversion Kits

Size	"A" (In.)	"B" (In.)	Connections (inches)				Water Content (gal.)	Approx Shipping Weight (lbs.)	Direct Vent Conversion Kit (part no.)
			Supply	Return	Gas Valve (NPT)	Vent			
X-PV3	12-3/4	2-3/4	1-1/4	1-1/4	1/2	3	2	260	110019-03
X-PV4	15-1/2	4	1-1/4	1-1/4	1/2	3	3	310	110019-04
X-PV5	18-1/2	5-1/2	1-1/4	1-1/4	1/2	3	4	360	110019-05
X-PV6	21-1/2	7	1-1/4	1-1/4	1/2	3	5	415	110019-06
X-PV7	24-3/4	8-1/2	1-1/4	1-1/4	3/4	3	6	470	110019-07
X-PV8	27-3/4	10	1-1/4	1-1/4	3/4	4	7	525	110019-08

Optional Accessories:

- Direct vent conversion kits – See chart (left) for part numbers
- System bypass kit w/Taco 007e – P/N: 107795-01
- Additional conversion kits for gas/LP and high altitude, consult your sales representative for details – NOTE: factory builds are available for gas & LP and high altitude, see chart above



Form No. USBL20071-10ms 10/20
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www.usboiler.net

Phone: 1-888-432-8887

U.S. Boiler Company

ITEM # 2

TriangleTube

"Tank-in-Tank" Technology

THE SMART CHOICE

in Domestic Hot Water

Smart Series

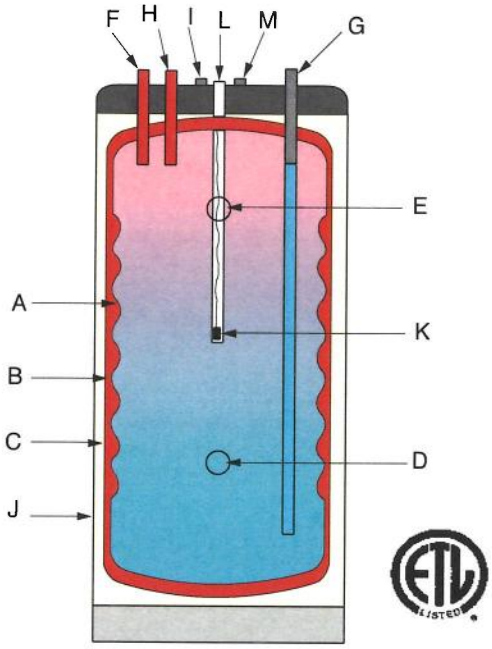
Stainless Steel Indirect Fired Water Heaters

- Exclusive "Tank-in-Tank" Technology
- Abundant Domestic Hot Water at the Lowest Possible Cost
- A Limited Residential Lifetime Warranty
- 2" of Polyurethane Foam Insulation
- Self Cleaning/Self Descaling Heat Exchanger
- Lowest Pressure Drop in the Industry
- 7 Sizes to Choose From

Construction Specifications

ITEM # 2

SMART Series



A. Inner stainless steel tank
B. Outer steel tank
C. 2" Polyurethane insulation
D. Boiler water connection
E. Boiler water connection
F. Hot water outlet
G. Cold water inlet
H. Auxiliary connection
I. Thermostat control
J. Plastic jacket
K. Thermostat remote sensing bulb
L. Air vent connection
M. Electrical wiring plug

Smart Series is tested in accordance with the standard (ANSI/UL-174) (CAN/CSA-C22.2 NO. 110-M90) and is certified by ETL.

Superior Design " Tank-in-Tank" Technology

Superior Heat Exchange Surface Area

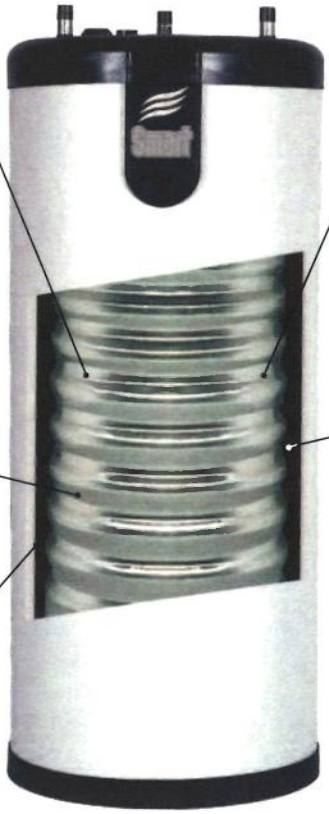
The domestic storage tank is constructed of stainless steel and is surrounded by boiler water in the outer tank, resulting in a full "wrap around" heat exchanger.
It's superior heat exchange surface (typically 1.5 to 2.5 times larger than a traditional coil) produces a larger volume of hot water in a short period of time. Thanks to this fast recovery, the storage capacity can be reduced, resulting in a reduced thermal loss.

Stainless Steel Tank Construction

The inner domestic storage tank is constructed of durable, corrosion resistant stainless steel.

Optimal Insulation

SMART Series, is insulated with 2" of injected polyurethane foam, resulting in a stand by heat loss of less than 1□/Hr.



Self Cleaning / Self - descaling

The inner, domestic tank is suspended within the outer tank so it is free to expand and contract as the pressure varies during hot water draws. Moreover, its corrugations amplify the movement and prevents the lime build up on the heat exchanger; thus maintaining its performance during the SMART Series life span.

Anti-Bacteria Growth / Maintenance Free

The "Tank-in-Tank" design allows us to store domestic water at higher temperatures preventing bacteria growth.
Additionally, contructed of high quality stainless steel, SMART Series does not require a protective anode.

Product Specifications

ITEM # 2

Model No.	Dimension	Height	Boiler/Supply Return	Domestic Inlet/Outlet	3rd Domestic Connection*	Domestic Capacity (gal.)	Heating Water Capacity (gal.)	Heat Surface (sq. ft.)	Empty Weight (lbs)
Smart 30	22" dia.	38"	1"	3/4"	3/4"	28	5	13	115
Smart 40	22" dia.	46"	1"	3/4"	3/4"	36	6	16	135
Smart 50	22" dia.	57"	1 1/4"	3/4"	3/4"	46	8	20	165
Smart 60	22" dia.	66"	1 1/4"	3/4"	3/4"	56	8	24	190
Smart 80	26" dia.	61"	1 1/2"	1 1/2"	1 1/2"	70	14	28	271
Smart 100	26" dia.	78"	1 1/2"	1 1/2"	1 1/2"	95	25	36	362
Smart 120	32" dia.	72"	2"	1 1/2"	1 1/2"	119	43	42	479

(*) This fitting can be used as a return connection if circulated domestic water is required or can be used as a connection for the T&P Relief Valve.

Performance

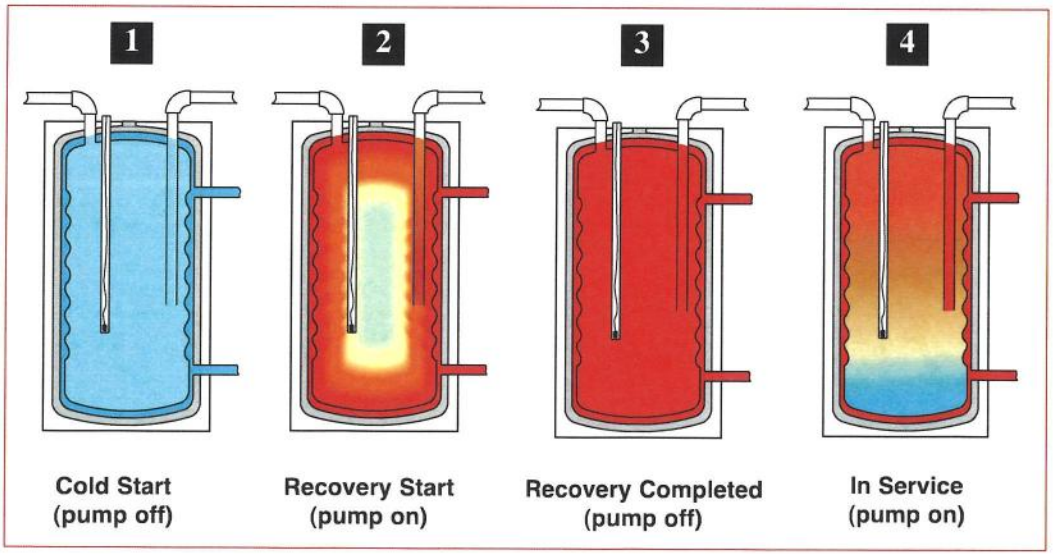
Model No.	Boiler Output Btu/hr	1st Hour Recovery (gal.)	Continuous Flow (gal.)	Peak/Flow Gal/10 min.
Smart 30	87,000	140	115	40
Smart 40	112,000	180	150	50
Smart 50	140,000	220	185	65
Smart 60	270,000	410	360	100
Smart 80	300,000	460	400	125
Smart 100	337,000	525	450	150
Smart 120	420,000	650	560	190

Conditions:

- 200° boiler water supply
- 90° temperature rise

How it Works

Smart Series operating cycle



When the thermostat in the inner tank calls for heat, the boiler and circulator start. Boiler water is circulated around the outer tank and heats the domestic water in the inner tank. After transferring its heat, boiler water is returned to the boiler to be re-heated. When the thermostat in the inner tank reaches its pre-set mark, the boiler and circulator shut off.

ITEM # 2

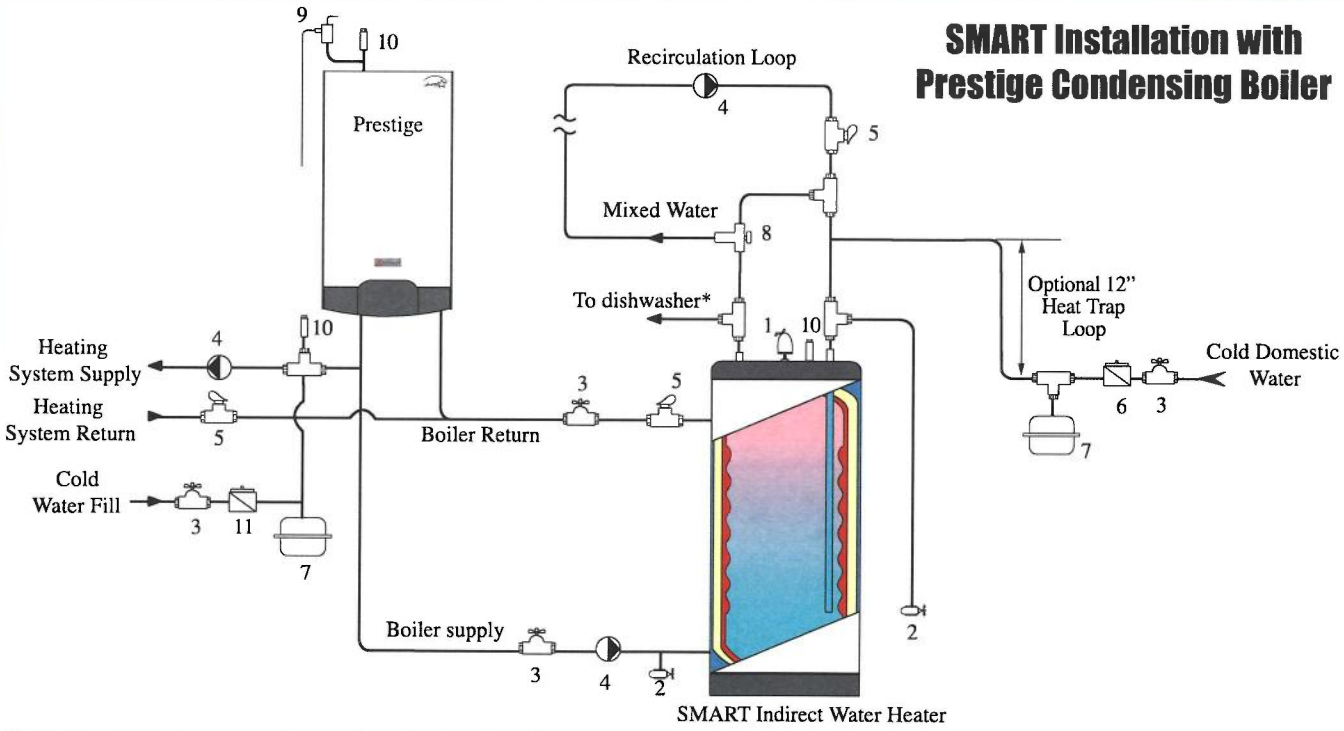
Energy Efficiency

The Stainless Steel Indirect Fired Water Heater is heated by the hot water from your boiler. As your home is being heated, your domestic hot water is being heated at the same time, thereby, consuming less fuel and conserving energy. Combine this with a recovery rate that is up to **three times faster** than conventional gas or electric water heaters, and The SMART Series Indirect Fired Water Heater heats more hot water with less fuel for the energy conscious consumer.

Long Term Dependability

The average life span of a SMART Series Indirect Fired Water Heater exceeds 20 years! That is two or three times the average life of a conventional gas, oil or electric water heater.

Installation



(*) Optional devices may be required by local codes.

1. Temperature & Pressure Relief Valve
2. Drain
3. Shut -off Valves
4. Circulator
5. Flow Check Valve
6. Backflow preventer or pressure reducing valve(*)
7. Expansion Tank
8. Mixing Valve
9. Pressure Relief Valve
10. Air Vent
11. Automatic Fill Valve

TriangleTube
One Triangle Lane • Blackwood NJ 08012
p 856.228.8881 f 856.228.3584 www.triangletube.com
Member of ACV Group

GRAINGER

ITEM # 2

Products Based on Your Search

Hydronic Circulating Pump: Std, Taco, Flange...

Compare

Web Price
$217.40 / each

Hydronic Circulating Pump: Std, Taco, Flange...

Compare

Web Price
$198.64 / each

Hydronic Circulating Pump: Std, Taco, Flange...

Compare

Web Price
$454.62 / each

Related Categories

Hydronic Circulating Pumps

Circulating Pumps, Flanges, Unions & Controls

Pumps

Hydronic Circulating Pumps / Hydronic Circulating Pump: Std, Taco...

Hydronic Circulating Pump: Std, Taco, Flanged, 1/25 HP, 10 ft Max. Head, 6 3/8 in Face to Face

Item **4PC90** Mfr. Model **007-F5**

Compare

Web Price
$239.38 / each

Qty 1 Add to Cart

Ship | Pickup

Expected to arrive **Fri. Nov 03.**

Ship to **08054** | Change

Shipping Weight **7.6 lbs**

Ship Availability Terms

Add to List

Product Details

Catalog Page 2657

Brand **TACO**

Manufacturer Part Number **007-F5**

Phase and Brand **TACO Single Phase**

Voltage **115V AC**

Body Gasket Material **EPDM**

Face to Face Dimension **6-3/8 in**

Includes **Flange Gaskets; Impedance Thermal Proctection**

Manufacturer Warranty Length **3 yr**

Maximum Feet of Head **10 ft**

Maximum Flow Rate @ 10 feet of Head **0 gpm**

Maximum Flow Rate @ 5 feet of Head **15 gpm**

Series Family **00**

Maximum Media Temperature **230 °F**

Maximum Operating Pressure **125 psi**

Mounting Location **In-Line**

Number of Speeds **1**

Overall Length **6.13 in**

Overall Width **4.75 in**

Pump Housing Material **Cast Iron**

Pump Type **Standard**

Rotor Type **Wet**

Series **007**

Standards **UL-CUS**

Horsepower **1/25**

Compatible Pipe Size **3/4 in; 1 in; 1-1/4 in; 1-1/2 in**

Connection Type **Flange**

Compliance & Restrictions

This product is not intended for potable water applications (human consumption - drinking and cooking) and has not been designed to be compliant with the "Safe Drinking Water Act" requirements for low lead in potable water applications. This item is for use only in non-potable (non-human consumption) water applications.

This item is restricted for conveying or dispensing water for potable use (human consumption).

Alternate Products

Hydronic Circulating Pump: Std, Taco, Flanged, 1/35 HP, 9 ft Max. Head, 115V AC

Item **5P427**

Compare

Web Price
$198.64 / each

Qty 1 Add to Cart

Maximum Flow Rate @ 1 Foot of Head **22 gpm**

Flange or Union Included **No**

Maximum RPM **3,250 RPM**

Nameplate Voltage **115V AC**

Phase **Single**

Minimum Media Temperature **40 °F**

Amps **0.71 A**

Compatible Discharge Pipe Size **3/4 in; 1 in; 1-1/4 in; 1-1/2 in**

Frequency **60 Hz**

UNSPSC **40151504**

Country of Origin **USA (subject to change)**

Product Description
Standard hydronic circulating pumps have fewer replaceable wear parts than 3-piece circulating pumps. These pumps are mounted to the pipe in-line near the water heater or boiler.

ITEM # 2

Compatible Products

TACO Flange: 3/4 in, Hydronic Pumps, 110-251F, For Use With 5CHJ9/5CHK1/5CHK7
Item **2KGW2**

Compare

Web Price
$25.27 / pkg. of 2

Qty 1 Add to Cart

TACO Flange: 1 in, Hydronic Pumps, 110-252F-1, For Use With 5CHJ9/5CHK1/5CHK7
Item **2KGW3**

Compare

Web Price
$23.62 / pkg. of 2

Qty 1 Add to Cart

TACO Flange: 1 1/4 in, Hydronic Pumps, 110-253F-1, For Use With 5CHJ9/5CHK1/5CHK7
Item **2KGW4**

Compare

Web Price
$24.36 / pkg. of 2

Qty 1 Add to Cart

TACO Flange: 1 1/2 in, Hydronic Pumps, 110-254F-1, For Use With 5CHJ9/5CHK1/5CHK7
Item **2KGW5**

Compare

Web Price
$24.36 / pkg. of 2

Qty 1 Add to Cart

Replacement Parts

REZNOR®

MODEL WS
INDOOR, SUSPENDED, STEAM OR HOT WATER
HYDRONIC UNIT HEATER FOR VERTICAL OR HORIZONTAL CONFIGURATION

ITEM # 3

DESCRIPTION

Reznor® Model WS Steam/Hot Water Suspended Heaters are design-engineered to be technically advanced and esthetically pleasing which makes it the hydronic heater for the 21st century.

This smart new concept in commercial heating units will accommodate all architects who are looking for something new and different.

The heating range of Model WS is 13,000 to 350,000 BTUH. The air volume ranges from 270 to 4,750 CFM.

The heat exchanger is made of one or two rows of steel coils (standard or optional copper coils) with aluminum fins, with approximately 10-1/2 fins per inch (4 fins per cm). The spacing between the fins makes cleaning and maintenance of the heat exchanger easier, which is essential to keep the unit heater efficient.

The standard steel tubing is very strong and long lasting. Steel tubing is designed for hot water applications up to 150 psi.

The copper tubing used for the heating coil is very thick (0.03", 0.75 mm), making Reznor heating coils extremely sturdy and long lasting. The copper tube diameter is 0.867" (22 mm) O.D. The large tube diameter reduces the water pressure drop, which means these units require lower pump pressure than other hydronic heaters. It also allows a very rapid heat radiation. **For steam heating applications copper tube (Option HA12) is required.** Designed for high working steam pressure up to 145 psi (10 bar), every heat exchanger is subjected to a pressure test at over 350 psi (25 bar) before leaving the factory.

The heat exchanger assembly receives a special paint coating which makes the coil long lasting and increases the thermal output.

The Fan/Motor Assembly is made up of three components: the fan, the motor and the fan guard, which also acts as the main support for the fan. This fan guard is galvanized for protection against corrosion, and is mounted onto the main casing with anti-vibration rubber mountings. The fan guard meets OSHA requirements.*

The standard 2-speed motor is a hermetically sealed motor which is maintenance free. The motor is wired for 115/1/60 supply voltage. The motor speed is field adjustable to run at high or low RPMs. Refer to the Technical Data Chart for fan RPM, heating output and CFM ranges.

The flexibility of changing motor speeds allows the installer to adjust the unit to high speed for increased BTUH output, or low speed for reduced noise level. All motors have internal protection as a standard feature.

All Model WS units can be installed for either vertical or horizontal discharge.

The unit cabinet is manufactured from .032" (0.8mm) galvanized pre-painted steel finished in dove gray. Using pre-painted steel helps protect the cabinet against oxidation.

The cabinet is held together by shake-proof screws and molded corner sections to add additional strength and durability. Adjustable louvers are held in place by spring loaded pivots. Vertical louvers are available for field installation.

The optional Air Flow Induction Optimizer is available for horizontally discharged units. The Air Flow Induction Optimizer increases the air flow due to the unique shape of its deflecting louvers which improves the throw of the heated air stream. See the optional accessories section for more information.

Units are packaged into strong corrugated cardboard cartons with strengthened upper and lower side sections. These containers are clearly marked with the model number, size and approximate shipping weight.

Units are manufactured in an ISO 9001 registered facility.

STANDARD FEATURES

STANDARD FEATURES

- Heat exchanger composed of steel tubes and aluminum fins spaced approximately 10-1/2 fins per inch
- Painted tubing heat exchanger and aluminum fins
- Hot water applications
- Fan/Motor Assembly includes galvanized fan guard
- Vertical or horizontal configuration
- Cabinet and louvers constructed of galvanized pre-painted steel
- Cabinet held together by shake-proof screws and molded corner sections
- Spring mounted horizontal louvers
- 115/60 single phase, two speed motor (field adjustable)
- Manufactured in an ISO 9001 registered facility

FACTORY INSTALLED OPTIONS

- Heat exchanger composed of 0.03" thick, .867" O.D copper tubes and aluminum fins spaced approximately 10-1/2 fins per inch
- Up to 145 psi steam applications with copper tubing

FIELD INSTALLED OPTIONS

- Vertical louvers for better air distribution - vertical or horizontal discharge
- Air flow induction louvers increase air flow and throw - horizontal discharge
- Light duty, or heavy duty thermostat
- Thermostat guard cover

OSHA requires that the fan guard spacing for a heater mounted 7 feet off the floor can not exceed 1/2 inch.

REZNOR®

TECHNICAL DATA

ITEM # 3

		Fan Speed	Size								
			18/24	23/33	44/62	60/85	78/110	96/120	140/175	190/238	300/350
Maximum Heating Capacity[A]	MBH	Low	18	23	44	60	78	96	140	190	300
		High	24	33	62	85	110	120	175	238	350
	Watts	Low	5,276	6,741	12,896	17,586	22,862	28,138	41,034	55,689	87,930
		High	7,034	9,672	18,172	24,914	32,241	35,172	51,293	69,758	102,585
	kcal/hr	Low	4,536	5,796	11,089	15,121	19,657	24,194	35,282	47,883	75,605
		High	6,048	8,317	15,625	21,421	27,722	30,242	44,103	59,980	88,206
Maximum Leaving Air Temperature (L.A.T.)[B]	°F	Low	121°	124°	132°	129°	125°	134°	134°	140°	133°
		High	115°	121°	126°	123°	121°	131°	130°	137°	128°
	°C	Low	49°	51°	56°	54°	52°	57°	57°	62°	56°
		High	46°	49°	52°	51°	49°	55°	54°	58°	53°
Approximate Fan RPM		Low	1,100	1,100	1,100	1,100	1,100	850	850	850	850
		High	1,550	1,600	1,600	1,600	1,600	1,080	1,080	1,080	1,080
Motor HP 115/1/60 Motor		Low	0.014	0.020	0.027	0.048	0.090	0.041	0.070	0.110	0.500
		High	0.040	0.055	0.082	0.150	0.260	0.090	0.160	0.250	1.140
Amp Rating 115/1/60 Motor		Low	0.3	0.4	0.6	1.1	1.7	0.9	1.1	2.2	6.5
		High	0.6	0.9	1.2	1.9	3.0	1.8	2.6	3.4	13.0
Noise Level at 16-1/2 ft (5m) - dB(A)		Low	45	46	49	54	57	47	49	52	61
		High	52	54	58	63	65	52	55	60	67
Approximate Air Volume	cfm	Low	270	330	560	800	1,100	1,200	1,750	2,200	3,800
		High	400	500	860	1,250	1,650	1,550	2,300	2,850	4,750
	m^3/hr	Low	459	561	952	1,359	1,869	2,039	2,973	3,738	6,457
		High	680	850	1,461	2,124	2,804	2,634	3,908	4,842	8,071
Supply Air Velocity	fpm	Low	382	443	522	549	578	500	590	613	755
		High	540	672	802	860	866	642	773	793	936
	m/min	Low	116	135	159	167	176	152	180	187	230
		High	165	205	244	262	264	196	236	242	285
Rows of Coils in Heat Exchanger			1	2	2	2	2	2	2	2	2
Water Content	Gallons		1/4	1/2	11/16	7/8	1	1 3/16	1 9/16	1 7/8	2 15/16
	Liters		1.0	2.0	2.6	3.2	3.8	4.6	6.0	7.0	11.1
Approximate Weight	lbs.		37	44	49	55	66	75	88	101	146
	Kg		17	20	22	25	30	34	40	46	66

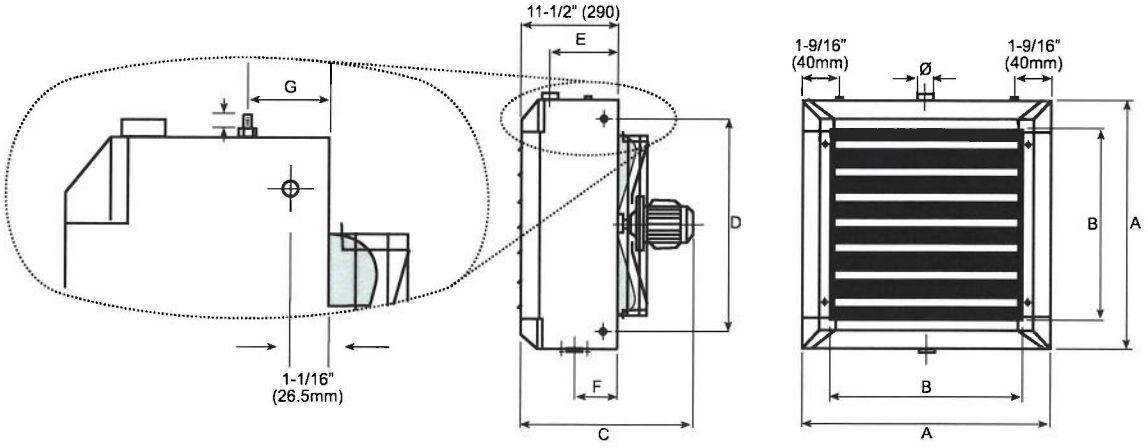
[A] Maximum heating capacity based on steam pressure at 2 psi with entering air temperature of 60°F (16°C) See tables on page 4 for more information.

[B] Based on an entering air temperature of 60°F (16°C).

DIMENSIONS

ACCURATE WITHIN ±1/8" (±3mm)

Size	A	B	C	D	E	F	G	Fan Diameter	Ø
18/24	16-7/16 (418)	11-1/8 (282)	18-5/16 (465)	12-5/8 (321)	8-11/16 (220)	5-1/8 (130)	3-15/16 (100)	11-13/16 (300)	3/4
23/33	16-7/16 (418)	11-1/8 (282)	18-5/16 (465)	12-5/8 (321)	8-11/16 (220)	5-1/8 (130)	3-15/16 (100)	11-13/16 (300)	3/4
44/62	18-9/16 (472)	13-1/4 (336)	18-5/16 (465)	14-3/4 (375)	8-11/16 (220)	5-1/8 (130)	3-15/16 (100)	13-3/4 (350)	1 1/4
60/85	20-11/16 (526)	15-3/8 (390)	18-5/16 (465)	16-7/8 (429)	8-11/16 (220)	5-1/8 (130)	3-15/16 (100)	15-3/4 (400)	1 1/4
78/110	22-13/16 (580)	17-1/2 (444)	18-5/16 (465)	19 (483)	8-11/16 (220)	5-1/8 (130)	4-3/4 (120)	17-11/16 (450)	1 1/4
96/120	24-15/16 (634)	19-5/8 (498)	19-3/16 (488)	21-1/8 (537)	8-11/16 (220)	5-1/8 (130)	4-3/4 (120)	17/11/16 (450)	1 1/4
140/175	27-1/16 (688)	21-3/4 (552)	19-3/16 (488)	23-1/4 (591)	8-11/16 (220)	5-1/8 (130)	4-3/4 (120)	19-11/16 (500)	1 1/4
190/238	29-3/16 (742)	23-7/8 (606)	20-3/16 (513)	25-3/8 (645)	8-11/16 (220)	5-1/8 (130)	5-1/8 (130)	21-5/8 (550)	1 1/4
300/350	35-7/16 (900)	30-1/16 (764)	22-5/8 (575)	31-5/8 (803)	8-1/4 (210)	5-1/2 (140)	5-1/8 (130)	25-9/16 (650)	1 1/2

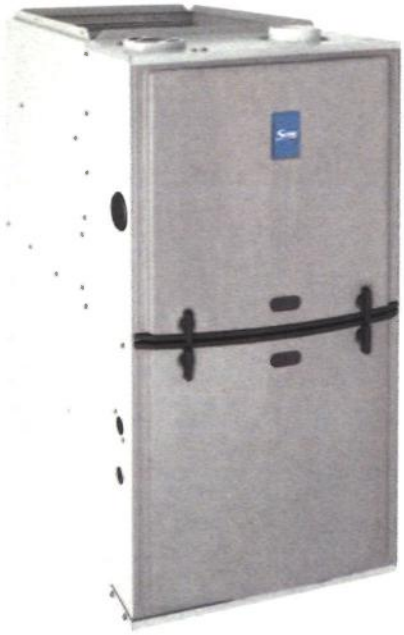


Real People. Real Savings. Real Fast.®

MODEL: S801C
Upflow/Horizontal Gas Furnaces

ITEM # 4

FORM NO. GSC-558 REV. 1



Sure Comfort® S801C
Upflow/Horizontal Gas Furnaces

- **80% A.F.U.E.†**
- **Models with Input Rates from 50 to 125 kBTU [15 to 37 kW]**

†A.F.U.E. (Annual Fuel Utilization Efficiency) calculated in accordance with Department of Energy test procedures.

- 80% residential Gas Furnace CSA certified
- 3 way multi poise design UF / HZ
- Diagnostics — 7 Segment LED all units
- Ignition System – DSI for reliability and longevity
- Heat exchanger is removable for improved serviceability. Aluminized steel construction provides maximum corrosion resistance and thermal fatigue reliability.
- Solid doors provide quiet operation
- Low profile 34" cabinet ideal for space constrained installations
- Blower shelf design – serviceable in all furnace orientations
- Hemmed edges on cabinets and doors
- 1/4 turn door knobs for tool less access
- Integrated Control board features dip switches for easy system set up
- QR code for quick access to product information from your smart phone or tablet
- Constant Torque electrically commutated motor
- Cabinet air leakage less than 2% at 1 inch H_2O when tested in accordance with ASHRAE standard 193

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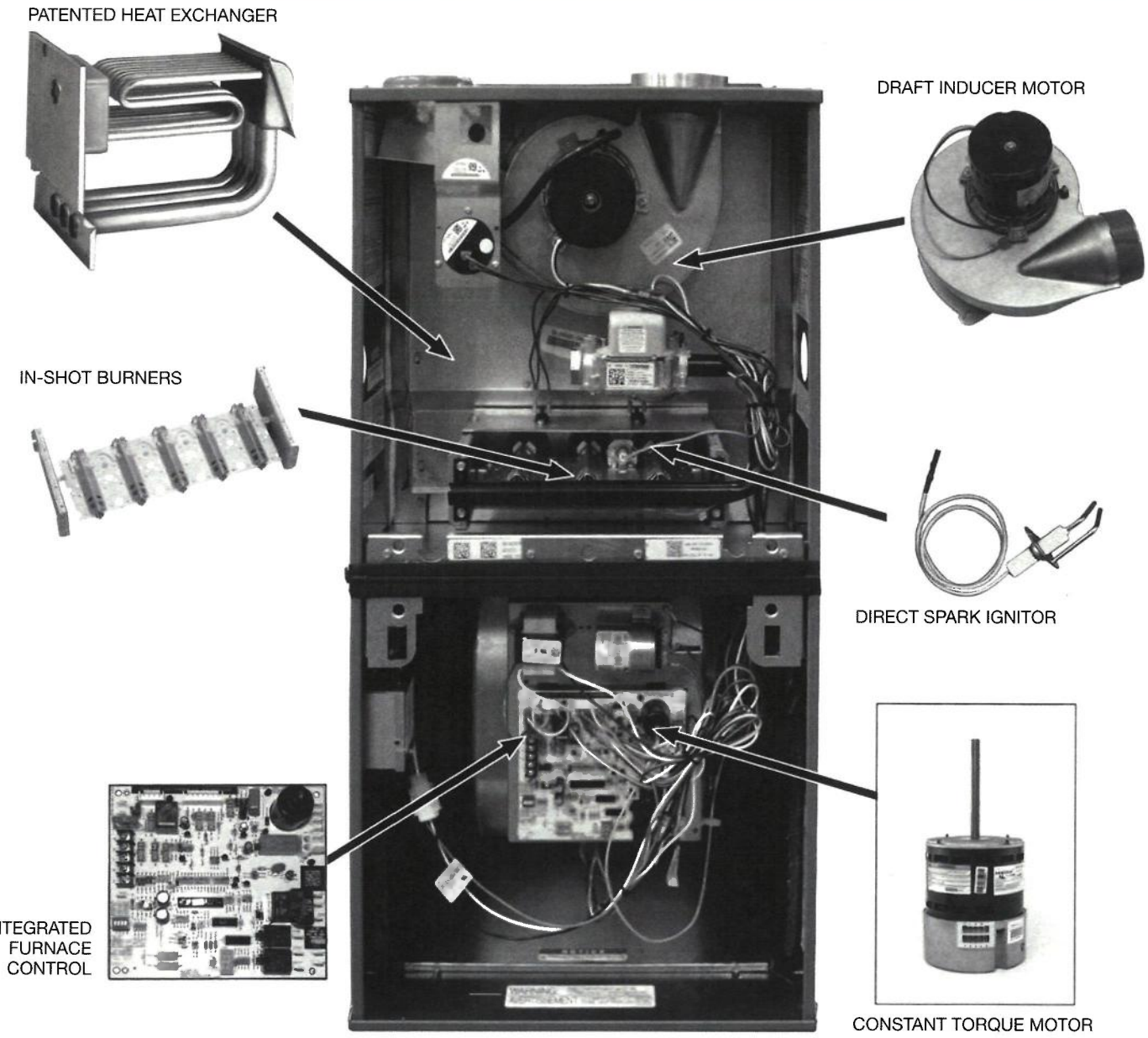

STANDARD EQUIPMENT

Completely assembled and wired; induced draft; pressure switch; redundant main gas control; blower compartment door safety switch; solid state time on/time off blower control; limit control; manual shut-off valve, pressure regulator for natural and L.P. (propane) gas; transformer; direct drive multi-speed blower motor. Furnaces are equipped with cooling/heating relay and transformer (40VA) ready for air conditioning applications. (Please note: a thermostat is not included as standard equipment.) Flame sensor diagnostics.

OPTIONAL EQUIPMENT

Side and bottom filter frame assembly. Return air cabinet for all sizes.

NOTE: Furnace is not listed for use with fuels other than natural or L.P. (propane) gas.

The complete terms of limited and other warranties are available at our sales office, or through local installer.

All models can be converted by a qualified Sure Comfort distributor or local service dealer to use L.P. (propane) gas without changing burners. Factory approved kits must be used to convert from natural to L.P. (propane) gas and may be ordered as optional accessories from a Sure Comfort parts distributor.

For L.P. (propane) operation, refer to Conversion Kit Index Form.

NOTE: For natural and L.P. (propane) gas models, direct spark ignition is 100% safety lockout type.

WARNING

THIS FURNACE IS NOT APPROVED
OR RECOMMENDED
FOR USE IN MOBILE HOMES

Model Features

- 80% residential Gas Furnace CSA certified
- 3 way multi poise design UF / HZ
- Diagnostics — 7 Segment LED all units
- Ignition System – DSI for reliability and longevity
- Heat exchanger is removable for improved serviceability. Aluminized steel construction provides maximum corrosion resistance and thermal fatigue reliability.
- Solid doors provide quiet operation
- Low profile 34" cabinet ideal for space constrained installations
- Blower shelf design serviceable in all furnace orientations
- Hemmed edges on cabinets and doors
- 1/4 turn door knobs for tool less access
- Integrated Controls board features dip switches for easy system set up
- QR code for quick access to product information from your smart phone or tablet
- Constant Torque electrically commutated motor

Physical Data and Specifications

MODEL NUMBERS S801C SERIES	S801CA050314M*A	S801CA075417M*A	S801CA075421M*A	S801CA100521M*A	S801CA125524M*A
Input-BTU/Hr [kW] ②	50,000 [15]	75,000 [22]	75,000 [22]	100,000 [29]	125,000 [37]
Heating Capacity BTU/Hr [kW] ①	40,000 [12]	60,000 [18]	60,000 [18]	80,000 [23]	100,000 [29]
Heat Ext. Static Pressure [kPa]	.18 [.05]	.20 [.05]	.20 [.05]	.28 [.07]	.28 [.07]
Blower (D x W) [mm]	11 x 6 [279 x 152]	11 x 7 [279 x 178]	11 x 7 [279 x 178]	11 x 10 [279 x 254]	11 x 10 [279 x 254]
Motor H.P.–Speed– PSC Type [W]	1/2-5 Spd Constant Torque [373]	1/2-5 Spd Constant Torque [373]	3/4-5 Spd Constant Torque [560]	3/4-5 Spd Constant Torque [560]	3/4-5 Spd Constant Torque [560]
Min. Circuit Ampacity	8	8	9	10	11
Min. Overload Protection Device	15	15	15	15	15
Max. Overload Protection Device	15	15	15	15	15
Heating Speed	Med-Low	Med	Med	Med-Low	Med
Cooling Speed	High	High	High	High	High
Cooling CFM @ Rating Point [L/s]	1305 [616]	1402 [662]	1608 [759]	1840 [868]	1934 [913]
Max. E.S.P. (In. W.C.) [kPa]	0.9 [.22]	0.9 [.22]	0.9 [.22]	0.9 [.22]	0.9 [.22]
Temperature Rise Range °F [°C]	25-55 [13.9-30.6]	25-55 [13.9-30.6]	25-55 [13.9-30.6]	35-65 [19.4-36.1]	35-65 [19.4-36.1]
Max. Outlet Air Temp. °F [°C]	155 [68.3]	155 [68.3]	160 [71.1]	180 [82.2]	165 [73.8]
Approx. Shipping Weight (Lbs.) [kg]	110 [50]	125 [57]	140 [64]	140 [64]	150 [68]
AFUE ①	80.0%	80.0%	80.0%	80.0%	80.0%

NOTES: All models are 115V, 60HZ, 1 Ph. Gas connection size for all models is 1/2" [12 mm] N.P.T.
① In accordance with D.O.E. test procedures.
② See Conversion Kit Index Form for high altitude derate.
③ S801SA075317 wired for 2 tons AC.
* S = Standard, X = Low NOx

This furnace does not meet air district requirements of 14 ng/J NOx emissions limit, and thus is subject to a mitigation fee of up to $450. This furnace is not eligible for the Clean Air Furnace Rebate Program: www.CleanAirFurnaceRebate.com.

This furnace is to be installed for propane firing only in air districts requiring 14 ng/J NOx emission limits. Operating in natural gas mode is in violation of these Rules.

[ ] Designates Metric Conversions

SURE COMFORT
Real People. Real Savings. Real Fast.®

ITEM # 4

MODEL: SA16
Air Conditioners

FORM NO. ASC-222 REV. 4

Sure Comfort® SA16 Air Conditioners

- **Efficiencies up to 16 SEER/13 EER**
- **Nominal Sizes 1 1/2 to 5 Ton [5.28 to 17.6 kW]**
- **Cooling Capacities 17.3 to 60.5 kBTU [5.7 to 17.7 kW]**

"Proper sizing and installation of equipment is critical to achieve optimal performance. Split system air conditioners and heat pumps must be matched with appropriate coil components to meet Energy Star. Ask your Contractor for details or visit www.energystar.gov."

- New composite base pan – dampens sound, secure wire grille, eliminates corrosion and reduces number of fasteners needed
- Powder coat paint finish – for a long lasting professional finish
- Scroll compressor – uses 70% fewer moving parts for higher efficiency and increased reliability
- Modern cabinet aesthetics – increased curb appeal with visually appealing design
- Curved louver panels – provide ultimate coil protection, enhance cabinet strength, and increased cabinet rigidity
- Optimized fan orifice – optimizes airflow and reduces unit sound
- Rust resistant screws – confirmed through 1500-hour salt spray testing
- Service valve has between 3"-4"-5" valve space – provides a minimum working area of 27-square inches for easier access
- 15" wide, industry leading corner service access – makes repairs easier and faster.
- External gauge port access – allows easy connection of "low-loss" gauge ports
- Single-row condenser coil – makes unit lighter and allows thorough coil cleaning to maintain "out of the box" performance
- Fewer cabinet fasteners – allow for faster access to internal components and hassle-free panel removal
- Service trays – hold fasteners or caps during service calls
- QR code – provides technical information on demand for faster service calls
- Fan motor harness with extra long wires allows unit top to be removed without disconnecting fan wire.

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Standard Feature Table

STANDARD FEATURES							
Feature	18	24	30	36	42	48	60
R-410a Refrigerant	√	√	√	√	√	√	√
Maximum SEER	16	16	16	16	16	16	16
Maximum EER	13	13	13	13	13	13	13
Scroll Compressor	√	√	√	√	√	√	√
Field Installed Filter Drier	√	√	√	√	√	√	√
Front Seating Service Valves	√	√	√	√	√	√	√
Internal Pressure Relief Valve	√	√	√	√	√	√	√
Internal Thermal Overload	√	√	√	√	√	√	√
Long Line capability	√	√	√	√	√	√	√
Low Ambient capability with Kit	√	√	√	√	√	√	√
Expanded Valve Space	√	√	√	√	√	√	√
Composite Basepan	√	√	√	√	√	√	√
3 Screw Control Box Access	√	√	√	√	√	√	√
15" Access to Internal Components	√	√	√	√	√	√	√
Optimized Venturi Airflow	√	√	√	√	√	√	√
Single row condenser coil	√	√	√	√	√	√	√
Powder coated paint	√	√	√	√	√	√	√
Rust resistant screws	√	√	√	√	√	√	√
QR code	√	√	√	√	√	√	√
External gauge ports	√	√	√	√	√	√	√
Service trays	√	√	√	√	√	√	√

√ = Standard

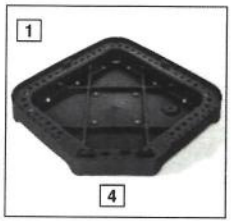
Available SKUs

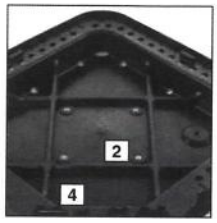
Available Models
SA1618AJ1NA
SA1618AJ1NB
SA1624AJ1NA
SA1624AJ1NB
SA1630AJ1NA
SA1630AJ1NB
SA1636AC1NB
SA1636AJ1NA
SA1636AJ1NB
SA1642AC1NB
SA1642AJ1NA
SA1642AJ1NB
SA1648AC1NB
SA1648AJ1NA
SA1648AJ1NB
SA1660AC1NB
SA1660AJ1NA
SA1660AJ1NB

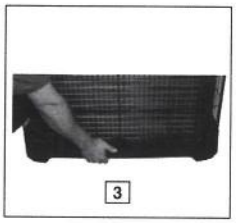
Introduction to SA16 Air Conditioner

The SA16 is our 16 SEER air conditioner and is part of the Sure Comfort air conditioner product line that extends from 13 to 17 SEER. This highly featured and reliable air conditioner is designed for years of reliable, efficient operation when matched with Sure Comfort indoor aluminum evaporator coils and furnaces or air handler units with aluminum evaporators.

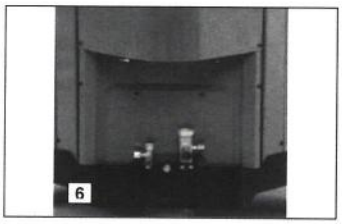
Our unique composite base ([1]) reduces sound emission, eliminates rattles, reduces fasteners, eliminates corrosion and has integrated brass compressor attachment inserts ([2]). Furthermore it has incorporated into the design, water management features, means for hand placement ([3]) for unit maneuvering, screw trays ([4]) and inserts for lifting off unit pad. ([5])

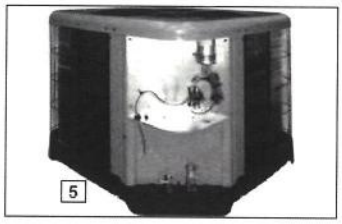




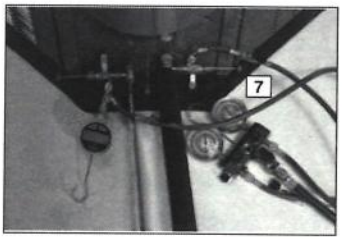


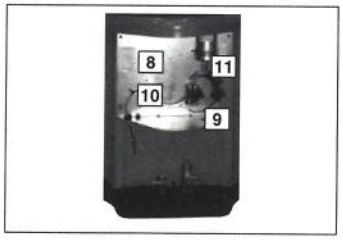
Service Valves ([6]) are rigidly mounted in the composite base with 3" between suction and discharge valves, 4" clearance below service valves and a minimum of 5" above the service valves, creating industry leading installation ease.





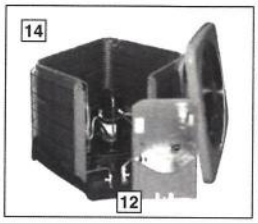
The minimum 27 square-inches around the service valves allows ample room to remove service valve schrader prior to brazing, plenty of clearance for easy brazing of the suction and discharge lines to service valve outlets, easy access and hookup of low loss refrigerant gauges ([7]), and access to the service valve caps for opening. For applications with long-line lengths up to 250 feet total equivalent length, up to 200 feet condenser above evaporator, or up to 80 feet evaporator above condenser, the long-line instructions in the installation manual should be followed.

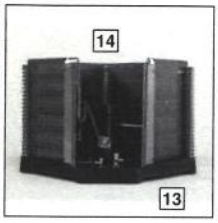




Controls are accessed from the corner of the unit by removing only three fasteners from the control access cover, revealing the industry's largest 15" wide and 14" tall control area ([8]). With all this room in the control area the high voltage electrical whip ([9]) can easily be inserted through the right size opening in the bottom of the control area. Routing it leads directly to contractor lugs for connection. The low voltage control wires ([10]) are easily connected to units low voltage wiring. If contactor or capacitor ([11]) needs to be replaced there is more than adequate space to make the repair.

If in the rare event, greater access is needed to internal components, such as the compressor, the top cover can be removed easily. Furthermore with the top cover removed the control panel can be removed ([12]). Extra wire length is incorporated into each outdoor fan and compressor so top cover and control panel can be positioned next to the unit. With minimal effort the plug can be removed from the compressor and the outdoor fan wires can be removed from the capacitor to allow even more uncluttered access to the interior of the unit ([13]). Outdoor coil heights range from as short as 22" to 32", aiding access to the compressor. Disassembly to this degree and complete reassembly only takes a first time service technician less than 10 minutes. ([13])



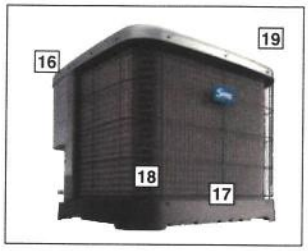


All SA16 units utilize single row coils ([14]) making cleaning easy and complete, restoring the performance of the air conditioner back to out of the box performance levels year after year.

The outdoor fan motor has sleeve bearings and is inherently protected. The motor is totally enclosed for maximum protection from weather, dust and corrosion. Access to the outdoor fan is made by removing four fasteners from the fan grille. The outdoor fan can be removed from the fan grille by removing 4 fasteners in the rare case outdoor fan motor fails.

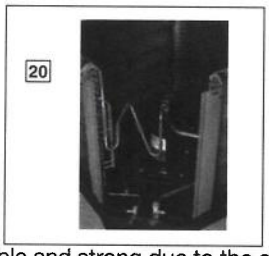
Each cabinet has optimized composite ([15]) fan orifice assuring efficient and quiet airflow.

All cabinet painted parts have powder post paint ([16]) achieving 1000 hour salt spray rating, allowing the cabinet to retain its aesthetics throughout its life.



Scroll compressors with standard internal pressure relief and internal thermal overload are used on all capacities assuring longevity of high efficient and quiet operation for the life of the product.

Each unit is shipped with filter drier for field installation and will trap any moisture or dirt that could contaminate the refrigerant system.



Cabinets are durable and strong due to the composite base pan ([17]), wire grille ([18]), and drawn top cover ([19]).

Each SA16 capacity has undergone rigorous psychometric testing to assure performance ratings of capacity, SEER and EER per AHRI Standard 210/240 rating conditions. Also each unit bears the UL mark and each unit is certified to UL 1995 safety standards.

Each unit has undergone specific strain and modal testing to assure tubing ([20]) is outside the units natural frequency and that the suction and discharge lines connected to the compressor withstand any starting, steady state operation or shut down forces imposed by the compressor.

All units have been sound tested in sound chamber to AHRI 270 rating conditions, and A-weighted Sound Power Level tables produced, assuring units have acceptable noise qualities (see page 9). Each unit has been ran in cooling operation at 95°F and 82°F and sound ratings for the SA16 range from as low as 74 dBA to 77 dBA.

All units have been ship tested to assure units meet stringent "over the road" shipping conditions.

As manufactured all units in the SA16 family have cooling capability to 55 °F. Addition of low ambient control will allow the unit to operate down to 0°F. Factory testing is performed on each unit. All component parts meet well defined specification and continually go through receiving inspections. Each component installed on a unit is scanned, assuring correct component utilization for a given unit capacity and voltage. All condenser coils are leak tested with pressurization test to 550#'s and once installed and assembled, each units' complete refrigerant system is helium leak tested. All units are fully charged from the factory for up to 15 feet of piping. All units are factory run tested. The SA16 has a 10-year conditional compressor and parts warranty (registration required).

Optional Accessories

(Refer to accessory chart for model #)

Compressor Crankcase Heater

Protects against refrigerant migration that can occur during low ambient operation

Compressor Sound Cover

- Reinforced vinyl compressor cover containing a 1½ inch thick batt of fiberglass insulation
- Open edges are sealed with a one-inch wide hook and loop fastening tape

Compressor Hard Start Kit

- Single-phase units are equipped with a PSC compressor motor, this type of motor normally does not need a potential relay and start capacitor
- Kit may be required to increase the compressor starting torque, in conditions such as low voltage

Low Ambient Kit

- Air conditioners operate satisfactorily in the cooling mode down to 55°F outdoor air temperature without any additional controls
- This Kit can be added in the field enabling unit to operate properly down to 0° in the cooling mode
- Crankcase heater and freezestat should be installed on compressors equipped with a low ambient kit

3"/6"/12"

- Gray high density polyethylene feet are available to raise unit off of mounting surface away from moisture

Low Pressure

- Can be added in field enabling the unit to shut off compressor on loss of charge

NOTE: Unit can be purchased with high and low pressure installed at factory. (Refer to SKU list)

High Pressure

- Can be added in field enabling unit to shut off compressor if unit loses outdoor fan operation.

NOTE: Unit can be purchased with high and low pressure installed at factory. (Refer to SKU list)

Decorative Top

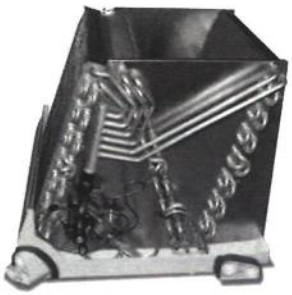
- Can be installed on fan grille

Real People. Real Savings. Real Fast.®

MODEL: TCF
Cased/Uncased Coils For Gas And Oil Furnaces

ITEM # 4

FORM NO. CSC-224 REV. 2



(TXV Metering Device Shown)

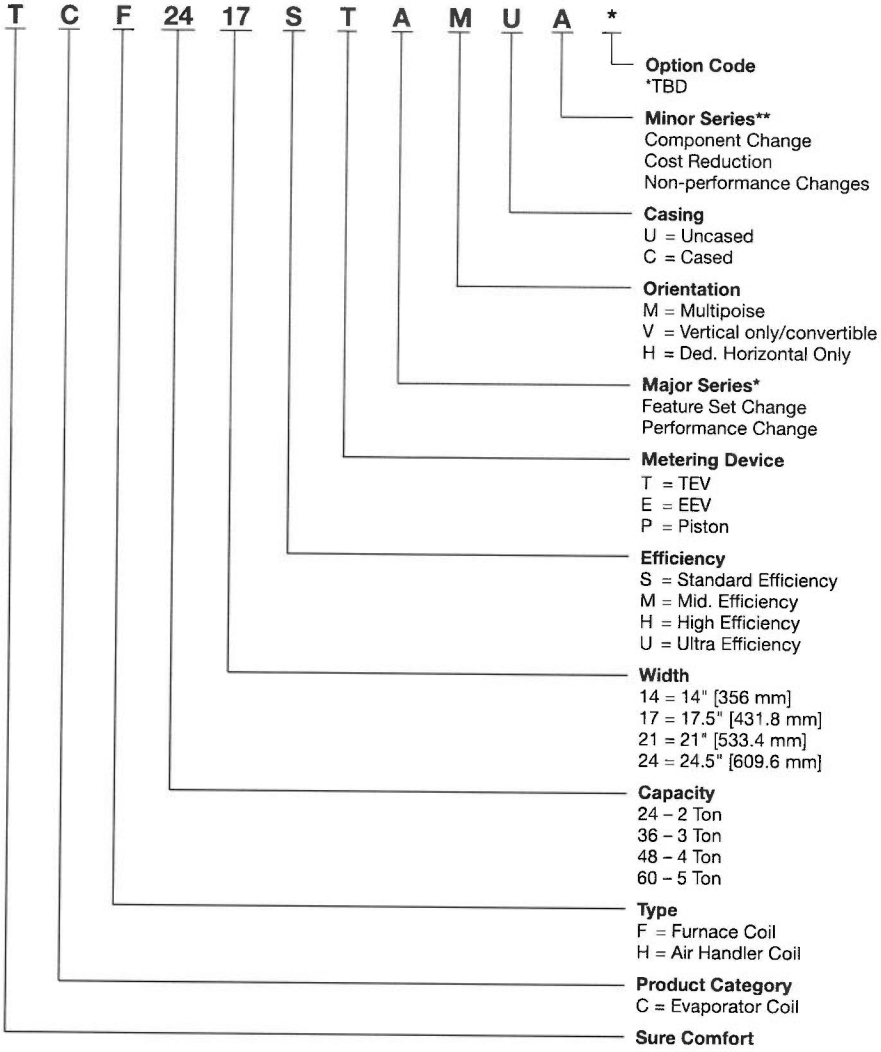
Sure Comfort® TCF Cased/Uncased Coils For Gas And Oil Furnaces

- **Featuring Industry Standard R-410A Refrigerant**
- **Airflow Capacity 600-1,900 CFM [283-897 L/s]**

- Sure Comfort® Indoor Furnace cased coils and replacement uncased coils are designed for use with Sure Comfort outdoor units and are available for vertical upflow or downflow, and horizontal left or horizontal right airflow. When matched with Sure Comfort outdoor units, the coils provide a nominal capacity range from 18,000 BTU/HR [5.24 kW] to 60,000 BTU/HR [17.6 kW].
- Constructed of aluminum fins bonded to internally grooved aluminum tubing.
- Coils are tested at the factory with an extensive refrigerant leak check.
- Coils have copper sweat refrigerant connections.
- Feature two sets of 3/4" [14.1 mm] N.P.T. Condensate drain connections for ease of connection.
- Chatleff metering device connections, at inlet and outlet of TXV or EEV and equalizer connections (TXV only).
- Approved for system application with variety of Sure Comfort outdoor units.
- Condensate drain pan is constructed of high grade, heat resistant, corrosion free thermal-set material.
- Compatible with Germicidal Light System (UV resistant)
- Bi-Directional airflow eliminates the need to switch any internal components from horizontal left to right.
- Unique drain pan design maximizes application flexibility and condensate removal.
- N-Coil design maximizes performance and minimizes height required at installation.
- Coils are AHRI certified for system application with a variety of Sure Comfort outdoor units.

Table of Contents

Model Number Identification



[ ] Designates Metric Conversions

TXV MODELS AVAILABLE	
TCF2414STAMCA	TCF2414STAVUA
TCF2417STAMCA	TCF2417STAVUA
TCF2417MTAMCA	TCF2417MTAVUA
TCF2417HTAMCA	TCF2417HTAVUA
TCF2421MTAMCA	TCF2421MTAVUA
TCF2421HTAMCA	TCF2421HTAVUA
TCF3617STAMCA	TCF3617STAVUA
TCF3621STAMCA	TCF3621STAVUA
*TCF3621MTAMCA	*TCF3621MTAVUA
TCF3621HTAMCA	TCF3621HTAVUA
TCF3624MTAMCA	TCF3624MTAVUA
TCF3624HTAMCA	TCF3624HTAVUA
TCF4821STAMCA	TCF4821STAVUA
*TCF4821MTAMCA	*TCF4821MTAVUA
TCF4824STAMCA	TCF4824STAVUA
TCF4824HTAMCA	TCF4824HTAVUA
*TCF6021STAMCA	*TCF6021STAVUA
*TCF6021MTAMCA	*TCF6021MTAVUA
TCF6024STAMCA	TCF6024STAVUA
TCF6024HTAMCA	TCF6024HTAVUA

EEV MODELS AVAILABLE	
TCF2417SEAMCA	TCF2417SEAVUA
TCF2421MEAMCA	TCF2421MEAVUA
*TCF2421UEAMCA	*TCF2421UEAVUA
TCF3617SEAMCA	TCF3617SEAVUA
TCF3621MEAMCA	TCF3621MEAVUA
*TCF6021SEAMCA	*TCF6021SEAVUA
TCF6024MEAMCA	TCF6024MEAVUA

PISTON MODELS AVAILABLE	
TCF2417SPAMCA	TCF2417SPAVUA
TCF3617SPAMCA	TCF3617SPAVUA
TCF3621SPAMCA	TCF3621SPAVUA
TCF4821SPAMCA	TCF4821SPAVUA
TCF4824SPAMCA	TCF4824SPAVUA

*Denotes A Coil

Table 1: Coil Specifications/Airflow Pressure Drop

Coil Model (-)CF	Approx. Design Cooling Air Flow Range CFM [L/s]	Face Area Sq. Ft. [m²]	Fins Per Inch / Rows Deep	Width	Nominal Capacity	Wet Coil Static Pressure Drop (Inches W.C.) [kPa] @ CFM [L/s] – (Coil Only)													
						600 [283]	700 [330]	800 [378]	900 [425]	1000 [472]	1100 [519]	1200 [566]	1300 [614]	1400 [661]	1500 [708]	1600 [755]	1700 [802]	1800 [850]	1900 [897]
TCF2414STAM	600/900 [283/425]	4.56 [0.42]	16/2	14	1.5 – 2	0.165	0.209	0.262	0.325	—	—	—	—	—	—	—	—	—	—
TCF2417STAM TCF2417SEAM	600/900 [283/425]	4.56 [0.42]	16/2	17		0.120	0.157	0.199	0.246	—	—	—	—	—	—	—	—	—	—
TCF2417MTAM	600/900 [283/425]	5.70 [.052]	16/2			0.113	0.145	0.181	0.222	—	—	—	—	—	—	—	—	—	—
TCF3617STAM TCF3617SEAM	700/1300 [330/614]	5.70 [0.52]	16/2		2.5 – 3	0.113	0.145	0.181	0.222	0.266	0.315	0.368	—	—	—	—	—	—	—
TCF2421MTAM TCF2421MEAM	600/900 [283/425]	5.70 [0.52]	16/2	21	1.5 – 2	0.113	0.145	0.181	0.222	—	—	—	—	—	—	—	—	—	—
TCF2421HTAM	600/900 [283/425]	5.70 [0.52]	16/2			0.113	0.145	0.181	0.222	—	—	—	—	—	—	—	—	—	—
TCF3621STAM	700/1300 [330/614]	5.70 [0.52]	16/2		2.5 – 3	0.113	0.145	0.181	0.222	0.266	0.315	0.368	—	—	—	—	—	—	—
TCF3621MTAM TCF3621MEAM	700/1300 [330/614]	8.55 [0.79]	16/2			0.062	0.086	0.112	0.140	0.170	0.202	0.236	—	—	—	—	—	—	—
TCF3621HTAM	700/1300 [330/614]	7.60 [0.70]	13/3			0.106	0.125	0.146	0.169	0.194	0.221	0.251	—	—	—	—	—	—	—
TCF4821MTAM	1100/1800 [519/850]	7.60 [0.70]	13/3		3.5 – 4	0.106	0.125	0.146	0.169	0.194	0.221	0.251	0.282	0.315	0.350	0.386	0.425	0.466	—
TCF4821STAM	1100/1800 [519/850]	8.55 [0.79]	16/2			0.062	0.086	0.112	0.140	0.170	0.202	0.236	0.272	0.309	0.349	0.391	0.434	0.480	0.527
TCF6021STAM TCF6021SEAM TCF6021MTAM TCF2421UEAM	1400/1600 [661/755]	7.60 [0.70]	13/3		2 – 5	0.036	0.050	0.065	0.081	0.098	0.117	0.137	0.158	0.180	0.203	0.228	0.254	—	—
TCF3624MTAM	700/1300 [330/614]	8.55 [0.79]	16/2	24	2.5 – 3	0.062	0.086	0.112	0.140	0.170	0.202	0.236	0.272	0.309	—	—	—	—	—
TCF3624HTAM	700/1300 [330/614]	9.98 [0.93]	14/3			0.036	0.050	0.065	0.081	0.098	0.117	0.137	0.158	0.180	—	—	—	—	—
TCF4824STAM	1100/1800 [519/850]	8.55 [0.79]	16/2		3.5 – 4	0.062	0.086	0.112	0.140	0.170	0.202	0.236	0.272	0.309	0.349	0.391	0.434	0.480	—
TCF4824HTAM	1100/1800 [519/850]	9.98 [0.93]	14/3			0.036	0.050	0.065	0.081	0.098	0.117	0.137	0.158	0.180	0.203	0.228	0.254	0.281	—
TCF6024STAM TCF6024MEAM	1400/1800 [661/755]	9.98 [0.93]	14/3		5	0.036	0.050	0.065	0.081	0.098	0.117	0.137	0.158	0.180	0.203	0.228	0.254	0.281	—
TCF6024HTAM	1400/1800 [661/755]	9.98 [0.93]	14/3			0.036	0.050	0.065	0.081	0.098	0.117	0.137	0.158	0.180	0.203	0.228	0.254	0.281	—

Important Note: Gas furnace heating CFM can exceed the design cooling CFM. Ductwork and coil selection must accommodate the higher of the cooling or gas heating CFM to prevent furnace limit tripping, excessive noise, and coil freeze-up.

[ ] Designates Metric Conversions

MANITOWOC

INDIGO NXT

ITEM # 5

iF-300 Ice Cube Machine

iF-300 Ice Cube Machine

Models

☐ IDF-0300A ☐ IYF-0300A ☐ IDF-0300W ☐ IYF-0300W

Indigo Series iF-300
Ice Machine on D-400 Bin

Designed for operators who know that ice is critical to their business, the Indigo®NXT Series ice machine's preventative diagnostics continually monitor itself for reliable ice production. Improvements in cleanability and programmability make your ice machine easy to own and less expensive to operate.

- **Space-Saving Design** – Measures only 16.5" high (42 cm) and 30" wide (76.20 cm) allowing it to fit on top of dispensers when a low ceiling is an issue.
- **easyTouch® Display**- New icon based touch screen takes the guess work out of owning and operating an ice machine.
- **Programmable Ice Production** – Now its super easy to program your ice machine to be off at certain times of the day to save money with fluctuating electrical rates. Also programmable by daily ice production volume.
- **Easy to Clean Foodzone** – Hinged front door swings out for easy access. Removable water-trough, distribution tube, curtain, and sensing probes for fast and efficient cleaning. Select components made with AlphaSan® antimicrobial.
- **Intelligent Diagnostics** – provide 24 hour preventative maintenance and diagnostic feedback for trouble free operation.
- **Acoustical Ice Sensing Probe** – Unique patented technology allows for reliable operation in challenging water conditions and environments.
- **DuraTech™ Exterior** – provides superior corrosion resistant above stainless steel. Innovative clear-coat resists fingerprints and dirt making it easier to keep clean.
- **Avaiable Luminice II Growth Inhibitor**- Controls the growth of bacteria and yeast with the food zone keep the machine cleaner longer. A new indicator in the display keeps you abreast of the operational status.

Ice Machine Electric

115/60/1 standard.
(208-230/60/1 and 230/50/1 also available.)

Minimum circuit ampacity:
Air-cooled: 10.8
Water-cooled: 10

Maximum fuse size:
15 amps *1ph*

Specifications

BTU Per Hour:
4,600 (average), 5,450 (peak)

Refrigerant:
R-404A CFC-free

Operating Limits:

- Ambient Temperature Range:
  40 to 110 F (4.4 to 43.3 C)
  Water Temperature Range:
  40 to 90 F (4.4 to 32.2 C)
- Water Pressure Ice Maker
  Water In:
  Min. 20 psi (137.9 kPA)
  Max. 80 psi (551.1 kPA)

Ice Shape

Half Dice
⅜" x 1⅛" x ⅞"
(.95 x 2.86 x 2.22 cm)

Dice
⅞" x ⅞" x ⅞"
(2.22 x 2.22 x 2.22 cm)

CALIFORNIA LOW LEAD QUALIFIED

NSF c UL US LISTED CE

AQ

COMPANY WITH QUALITY SYSTEM CERTIFIED BY DNV = ISO 9001:2008 =

2110 South 26th Street
Manitowoc, WI 54220

Tel: 1.920.682.0161
Fax: 1.920.683.7589

www.manitowocice.com

WELBILT

MANITOWOC

Indigo®NXT iF-300 Ice Cube Machine

iF0300 on a D400 Storage Bin

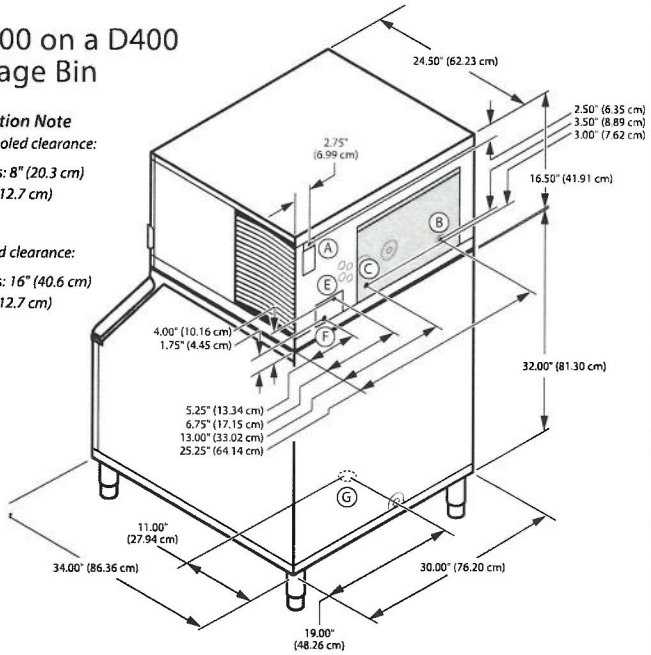
Installation Note

Water Cooled clearance:

Top/Sides: 8" (20.3 cm)
Back: 5" (12.7 cm)

Air Cooled clearance:

Top/Sides: 16" (40.6 cm)
Back: 5" (12.7 cm)



Ⓐ Electrical Entrance (2) Options
Ⓑ 3/8" (0.95 cm) F.P.T. Water Condenser Inlet (water-cooled units)
Ⓒ 1/2" (1.27 cm) F.P.T. Water Condenser Outlet (water-cooled units)
Ⓓ 1/2" (1.27 cm) Auxillary Base Drain Socket
Ⓔ 3/8" (0.95 cm) F.P.T. Ice Making Water Inlet
Ⓕ 1/2" (1.27 cm) F.P.T. Ice Making Water Drain
Ⓖ 3/4" (1.91 cm) Bin Drain

Space-Saving Designs

iF0300
D-400

Height	54.50" 138.43 cm
Width	30.00" 76.20 cm
Depth	34.00" 86.30 cm
Bin Storage	365 lbs. 165.7 kgs.

Height includes adjustable bin legs 6.00" to 8.00", (15.24 to 20.32 cm) set at 6.00" (15.24 cm).

Storage bin rated at application capacity based on 90% of the volume x 33 lbs/ft3 average density of ice.

Specifications

	Model	Ice Shape	Ice Production 24 Hours		Power Usage kWh/100 lbs. @90°Air/70°F	Water Usage/ 100 lbs. 45.4 kgs. of Ice
			70°Air/ 50°F Water	90°Air/ 70°F Water	1 Ph	Potable Water
AIR-COOLED	IDF0300A	dice	325 lbs.	240 lbs.	6.95	20.0 gal
			147 kgs.	108 kgs.		75.7 L
	IYF0300A	half-dice	325 lbs.	240 lbs.	6.95	20.0 gal
			147 kgs.	108 kgs.		75.7 L
WATER-COOLED	IDF0300W	dice	310 lbs.	250 lbs.	5.45	20.0 gal
			140 kgs.	118 kgs.		75.7 L
	IYF0300W	half-dice	310 lbs.	260 lbs.	5.50	20.0 gal
			140 kgs.	118 kgs.		75.7 L
	* Water-cooled Condenser Water Usage / 100 lbs. /45.4 kgs. Of Ice: 180 gal / 681 L . * Water-cooled models are excluded from ENERGY STAR qualification.					

Order ice storage bin separately.

Accessories

Luminice® II Growth Inhibitor
reduces yeast and bacteria growth for a cleaner ice machine.

External Scoop holder
Protect the ice scoop with the NSF approved versatile scoop holder.

Arctic Pure® Water Filters
Reduces sediment and chlorine odors for better tasting ice.

iAuCS®
schedules and performs routine ice machine cleaning automatically.

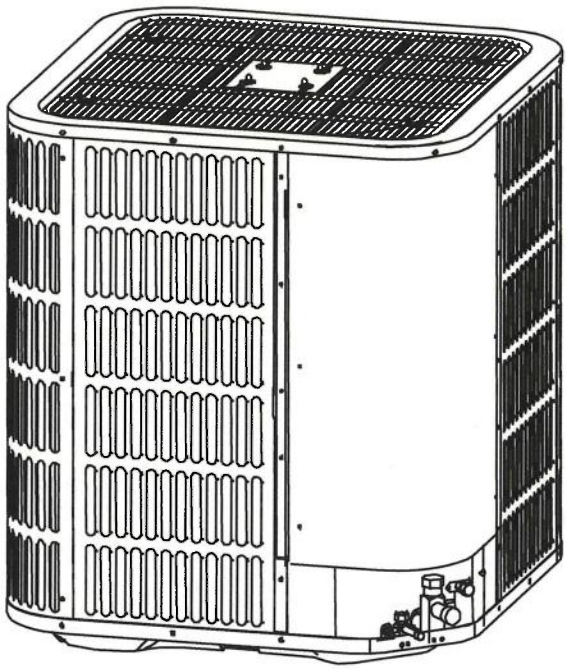
2110 South 26th Street
Manitowoc, WI 54220

Tel: 1.920.682.0161
Fax: 1.920.683.7589

www.manitowocice.com
6585A 07/19

WELBILT

ITEM # 6



Bosch BOVA Split System Heat Pump

Condensing Units Up to 18 SEER
2-3-4-5 Ton Capacity
R410A

BOSCH

Product Specifications

AHRI CERTIFIED www.ahridirectory.org Unitary Small AC AHRI Standard 210/240

AHRI CERTIFIED www.ahridirectory.org Unitary Small HP AHRI Standard 210/240

ETL LISTED c US Intertek

1 Product features

1.1 Standard features

- R-410A chlorine-free refrigerant
- Load 25%-110%
- Intelligent oil return technology
- Inverter Driven Rotary Compressor
- Crankcase Heater Standard
- Compressor Sound Blanket
- Multiple System Protection:
  - High pressure switch and low pressure transducer
  - Compressor Liquid return protection
  - Compressor high or low compression ratio protection
  - Compressor high temperature Protection
  - High / low voltage Protection and Over Current Protection
  - IPM and electronic control board high temperature Protection
- AHRI certified; ETL listed

1.2 Cabinet features

- Unique sound control top design
- Baked-on powder paint finish
- Wind Load compliant per Florida Building Code - 2010
- Wire fan discharge grille
- Steel louver coil guard

2 Nomenclature

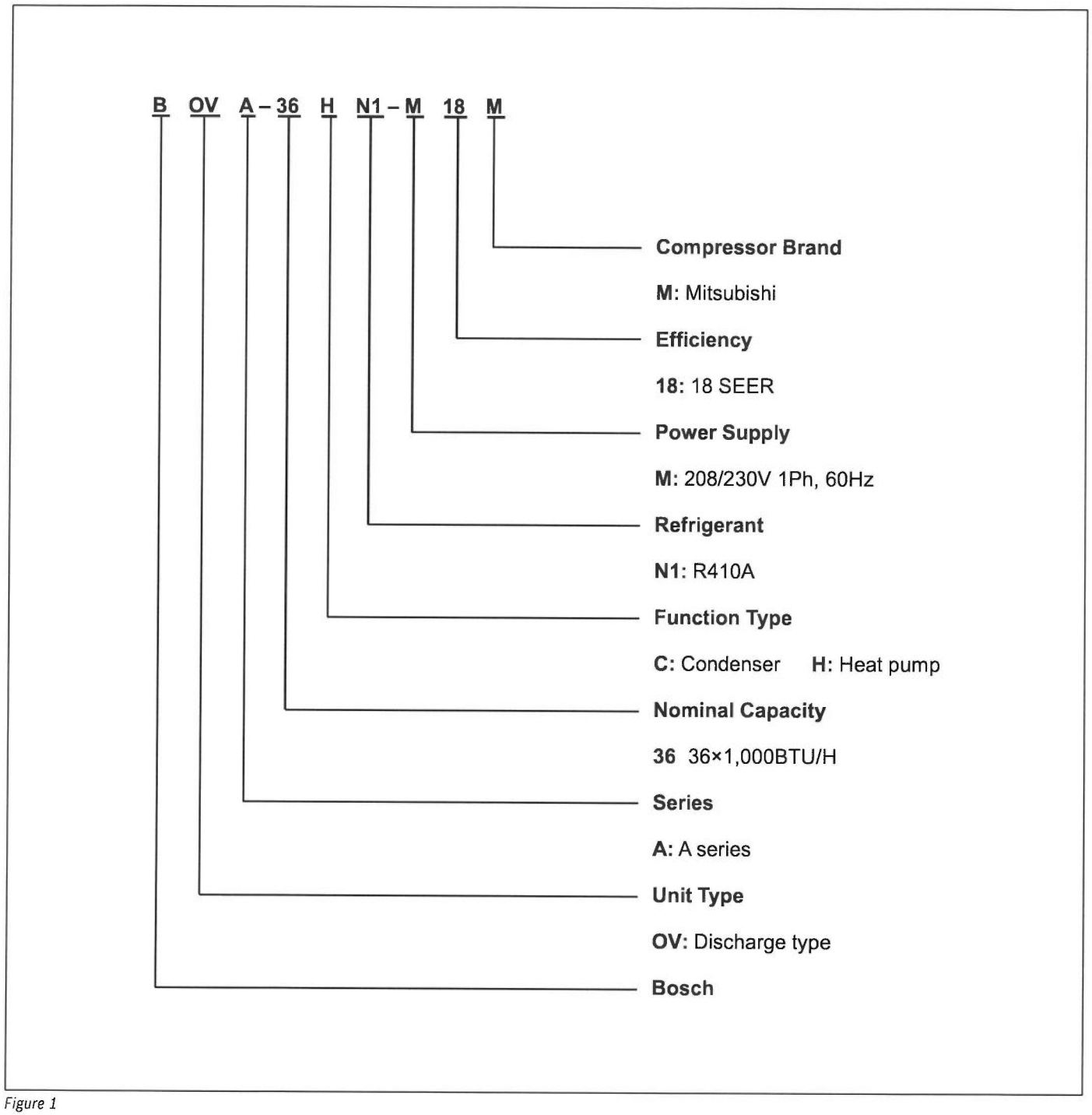


Figure 1

6 Dimensions

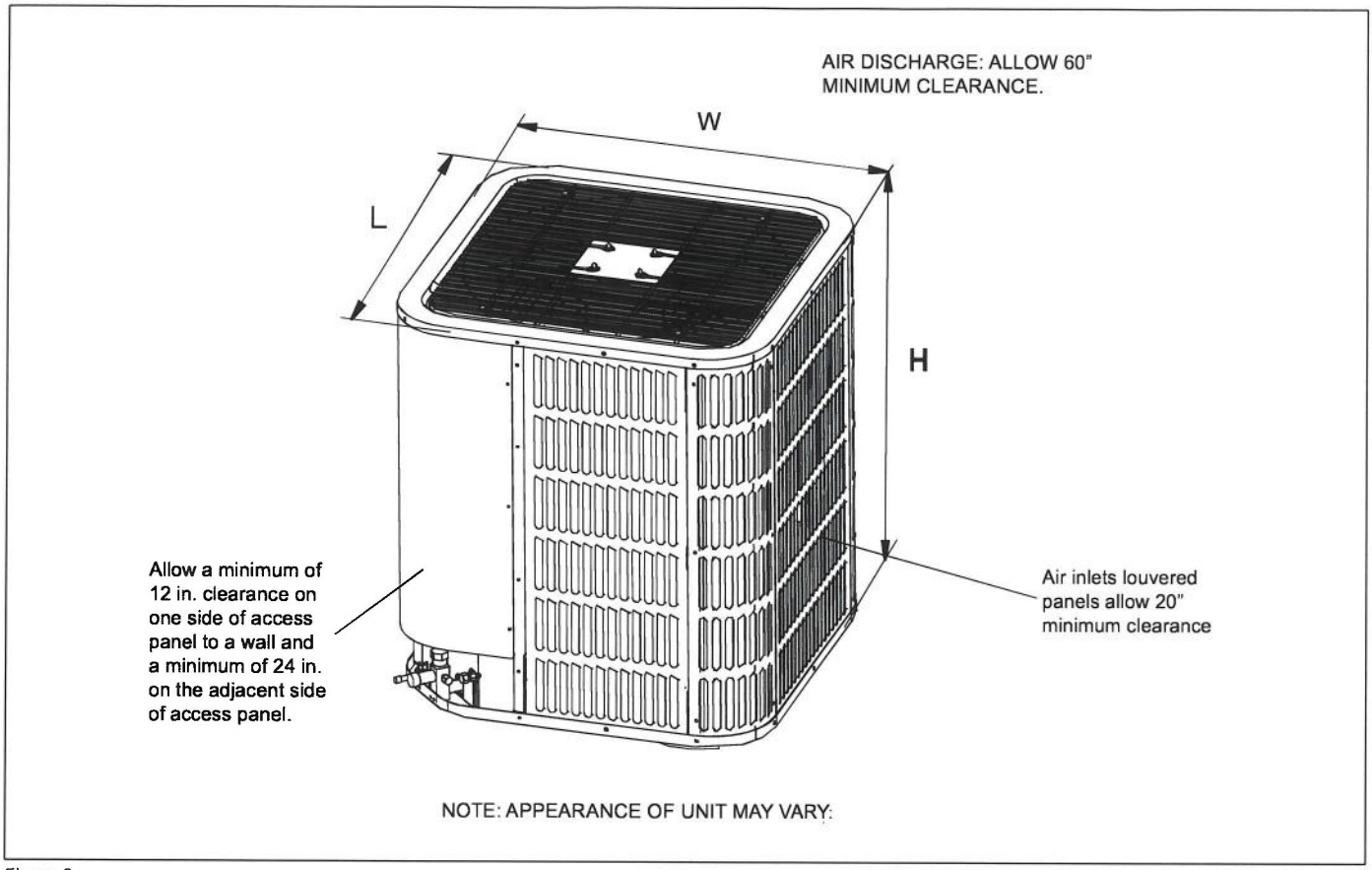


Figure 2

Model Size	Dimensions (Inches)		
Heat Pump	"H" in. [mm]	"W" in. [mm]	"L" in. [mm]
BOVA 36	24-15/16 [633]	29-1/8 [740]	29-1/8 [740]
BOVA 60	33-3/16 [843]	29-1/8 [740]	29-1/8 [740]

Table 11

Suction line length/size vs capacity multiplier(R410A)

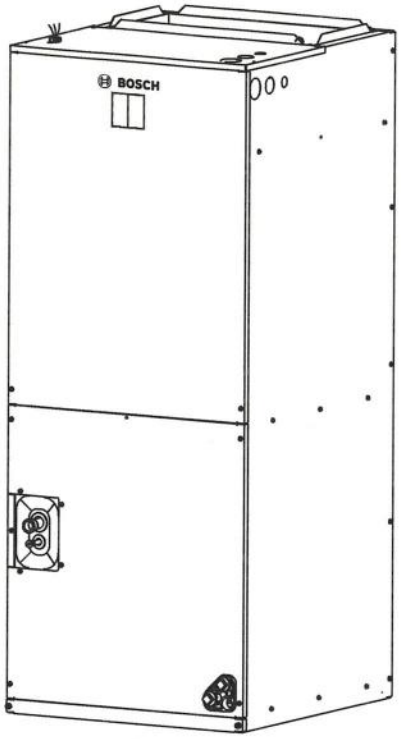
Model Size		2 Ton	3 Ton	4 Ton	5 Ton
Suction Line Connection Size		3/4" O.D.	3/4" O.D.	7/8" O.D.	7/8" O.D.
Suction Line Run - Feet		5/8 Opt.	5/8 Opt.	3/4 Opt.	3/4 Opt.
		3/4* Std.	3/4* Std.	7/8* Std.	7/8* Std.
25'	Optional	1.00	1.00	1.00	0.99
	Standard	1.00	1.00	1.00	1.00
50'	Optional	0.98	0.98	0.98	0.97
	Standard	0.99	0.99	0.99	0.98
100'	Optional	0.95	0.95	0.95	0.94
	Standard	0.96	0.97	0.97	0.96

Table 12

* Standard size

Using suction line larger than shown in chart will result in poor oil return and is not recommended.

ITEM # 6



Bosch BVA 2.0 Series Air Handler

2-3-4-5 Ton Capacity
R410A

BOSCH

Product Specifications

AHRI CERTIFIED
www.ahridirectory.org
Unitary Small HP
AHRI Standard 210/240
Certification applies only when the complete system is listed with AHRI

C ETL LISTED US
Intertek

Table of Contents

1 Product Features

1.1 Features and Benefits

- Premium efficiency – Up to 20.5 SEER, up to 10.5 HSPF
- All aluminum evaporator coil for superior corrosion resistance
- Constant torque multi-speed ECM blower motor - designed for two stage operation
- 5, 8, 10, 15, 20 kW electric heat accessory kits available for supplemental or emergency heating needs
- Easy to install – compatible with most standard 24 VAC heat pump thermostats
- Factory-installed TXV metering
- Multi-position Installation - upflow or horizontal right standard; field convertible to horizontal left or downflow
- Multiple electrical entry locations
- Dual front panel design for ease of maintenance
- Blower and coil easy slide out for ease of maintenance
- Fully-insulated cabinet design
- Horizontal and vertical condensate drain pans standard
- Condensate drain pan is polymer with UVC inhibitor
- Primary and secondary condensate drain fittings
- Factory-sealed cabinet certified to achieve 2% or less air leakage rate at 1.0 inch water column
- Integrated filter rack with tool-less door access
- AHRI and ETL Listed

1.2 Limited Warranty

For Products installed in a one or two family residential dwelling, BTC warrants that all compressors and internal components incorporated into the Product at the time of shipment by BTC shall remain free from defects in workmanship and materials for ten (10) years* from the Commencement Date. If the Warranty Registration process has been completed and BTC determines that the Product or any part of the Product has a defect in workmanship or materials, BTC shall pay labor charges associated with the repair or replacement of the part in accordance with the Warranty Labor Allowance Schedule** for the period of ninety (90) days from the Commencement Date.

* Please refer to www.bosch-climate.us for full warranty terms and conditions.

** Warranty Labor Allowance Schedule details are available on www.boschprohvac.com

2 Nomenclature

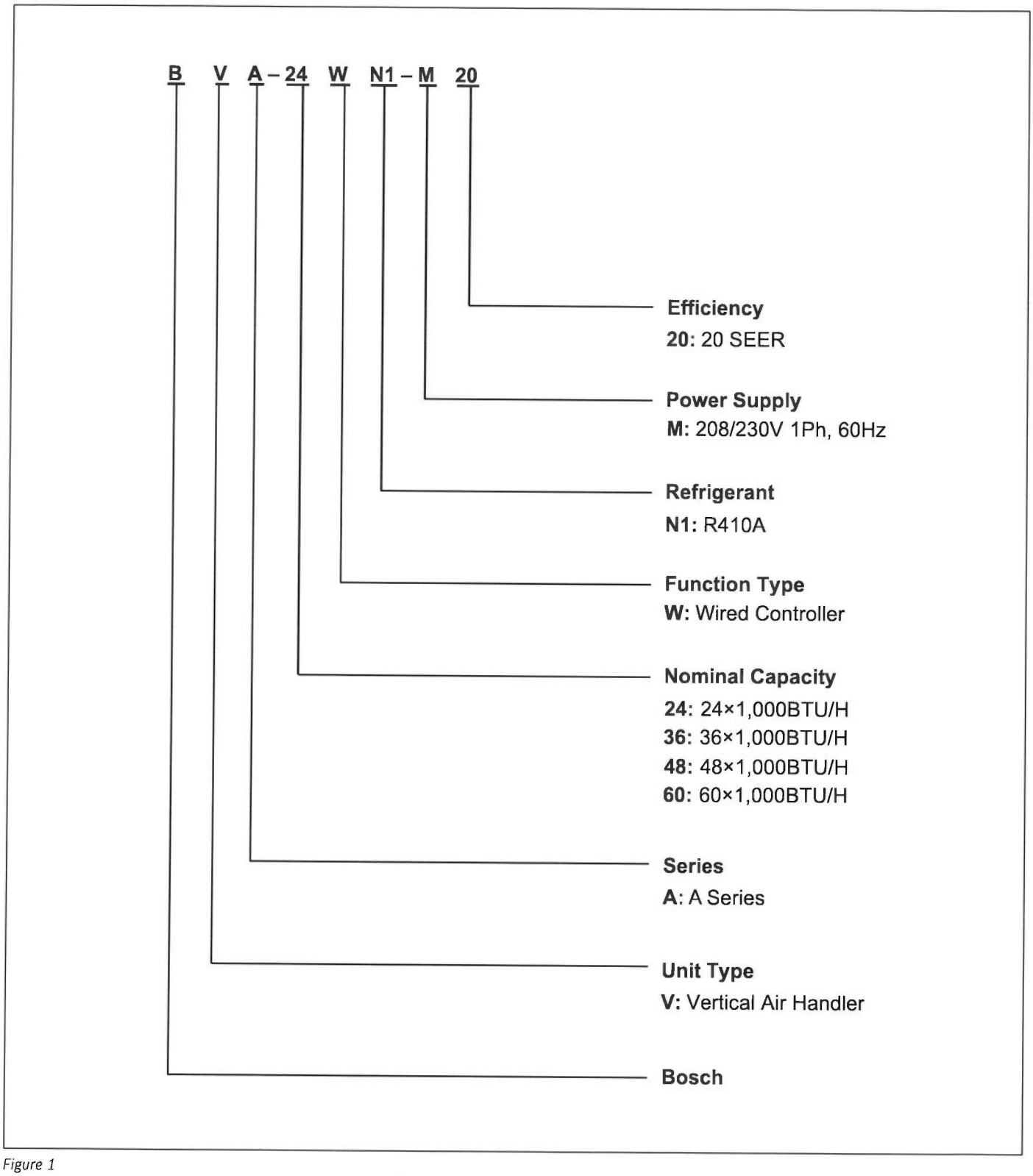


Figure 1

3 Product specifications

	BVA024	BVA036	BVA048	BVA060
Cooling Capacity				
Nominal Cooling (BTU/h)	24000	34600	47500	54500
Nominal Heating (BTU/h)	24000	34200	48000	56000
Blower				
Diameter (mm)	10-5/8" (270)	10-63/64" (279)	10-63/64" (279)	10-63/64" (279)
Width (mm)	8-5/32" (207)	10-43/64" (271)	10-43/64" (271)	10-43/64" (271)
Fan Motor				
Horsepower (HP)	1/3	1/2	3/4	3/4
Full Load Amps	2.6	3	4.5	4.5
Refrigeration System				
Refrigerant Line Size[1]				
Liquid Line Size (O.D.)	3/8"	3/8"	3/8"	3/8"
Suction Line Size (O.D.)	3/4"	3/4"	7/8"	7/8"
Refrigerant Connection Size				
Liquid Line Size (O.D.)	3/8"	3/8"	3/8"	3/8"
Suction Line Size (O.D.)	3/4"	3/4"	7/8"	7/8"
Expansion Device [TXV=Thermal Expansion Valve]	TXV			
Decibels dB(A)				
High Speed	63	65	67	68
Medium Speed	59	62	63	64
Low Speed	55	58	59	60
Electrical Data				
Voltage-Phase-Hz	208/230-1-60	208/230-1-60	208/230-1-60	208/230-1-60
Minimum Circuit Ampacity[2]	3.3	3.8	5.7	5.7
Max. Overcurrent Protection[3]	15	15	15	15
Min / Max Volts	172V/270V			
Air Filter				
Air Filter Sizes	18" x 20"	18" x 20"	20" x 22"	20" x 22"
Weight				
Net Weight (without packaging) (lbs)	119	126	162	170
Gross Weight (including packaging) (lbs)[4]	132	139	180	188
Dimensions				
Unit D x W x H (in.)	21-5/8 x 19-5/8 x 46-1/2	21-5/8 x 19-5/8 x 46-1/2	24 x 22 x 54-1/2	24 x 22 x 54-1/2
Unit D x W x H (in.) (with pallet and packaging)	25-3/8 x 22-5/16 x 52-9/16	25-3/8 x 22-5/16 x 52-9/16	27-11/16 x 24-11/16 x 60-5/8	27-11/16 x 24-11/16 x 60-5/8
Indoor Coil				
Net face area-sq.ft.	4.02	4.02	5.99	5.99
Tube diameter	9/32" (7 mm)	9/32" (7 mm)	9/32" (7mm)	9/32" (7mm)
No.of rows	4	4	4	5
Fins per inch	17	17	17	17

Table 1

[1] Tested and rated in accordance with AHRI Standard 210/240.

[2] Wire size should be determined in accordance with National Electrical Codes; extensive wire runs will require larger wire sizes.

[3] Must use time-delay fuses or HACR-type circuit breakers of the same size as noted.

[4] Weight shown includes packaging

4 Dimensions

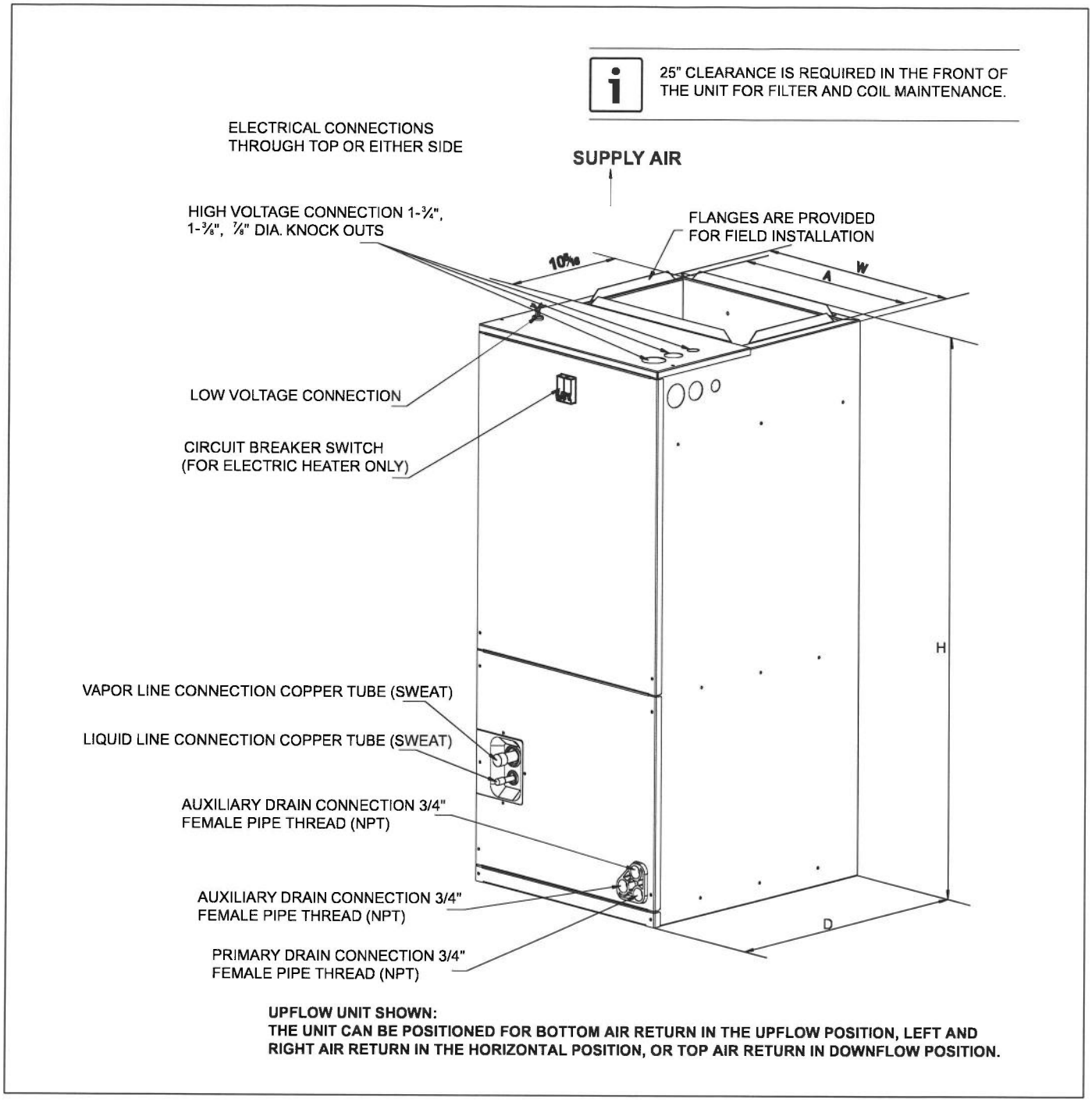


Figure 2

Model Size	Dimensions Inch [mm]				
	Unit Height "H"	Unit Width "W"	Unit Length "D"	Supply Duct "A"	Liquid Line / Vapor Line
24	46-1/2 [1180]	19-5/8 [500]	21-5/8 [550]	18 [456]	3/8 / 3/4 [9.5]/[19]
36	46-1/2 [1180]	19-5/8 [500]	21-5/8 [550]	18 [456]	3/8 / 3/4 [9.5]/[19]
48	54-1/2 [1385]	22 [560]	24 [610]	19-1/2 [496]	3/8 / 7/8 [9.5]/[22]
60	54-1/2 [1385]	22 [560]	24 [610]	19-1/2 [496]	3/8 / 7/8 [9.5]/[22]

Table 2

Electric Heat Accessory

ITEM # 6

Installation Instructions

EHK05AKN/B, EHK07AKN/B, EHK10AKN/B, EHK15AKF/B, EHK20AKF/B, EHK15AHN, EHK18AHN, EHK09AKCN, EHK25AHCF, EHK30AHCF

Safety Labeling and Signal Words

DANGER, WARNING, CAUTION, and NOTE

The signal words **DANGER, WARNING, CAUTION,** and **NOTE** are used to identify levels of hazard seriousness. The signal word **DANGER** is only used on product labels to signify an immediate hazard. The signal words **WARNING, CAUTION,** and **NOTE** will be used on product labels and throughout this manual and other manuals that may apply to the product.

DANGER – Immediate hazards which **will** result in severe personal injury or death.

WARNING – Hazards or unsafe practices which **could** result in severe personal injury or death.

CAUTION – Hazards or unsafe practices which **may** result in minor personal injury or product or property damage.

NOTE – Used to highlight suggestions which **will** result in enhanced installation, reliability, or operation.

Signal Words in Manuals

The signal word **WARNING** is used throughout this manual in the following manner:

⚠ WARNING

The signal word **CAUTION** is used throughout this manual in the following manner:

⚠ CAUTION

Signal Words on Product Labeling

Signal words are used in combination with colors and/or pictures on product labels.

WARNING

ELECTRICAL SHOCK HAZARD.

Failure to follow this warning could result in death and/or personal injury.

Installation or repairs made by unqualified persons can result in hazards to you and others. Installation must conform with local building codes or, in the absence of local codes, with National Electrical Code ANSI/NFPA 70–1996 or current edition.

The information contained in this manual is intended for use by a qualified service technician familiar with safety procedures and equipped with the proper tools and test instruments.

Shut OFF electric power at unit disconnect and/or service panel before beginning the following procedures.

INSTALLATION

INSTALL ELECTRIC HEATER ASSEMBLY

NOTE: Ensure heater coils are not deformed or damaged during heater installation.

1. Make sure power to unit is off.
2. Remove blower access panel of fan coil unit.

⚠ CAUTION

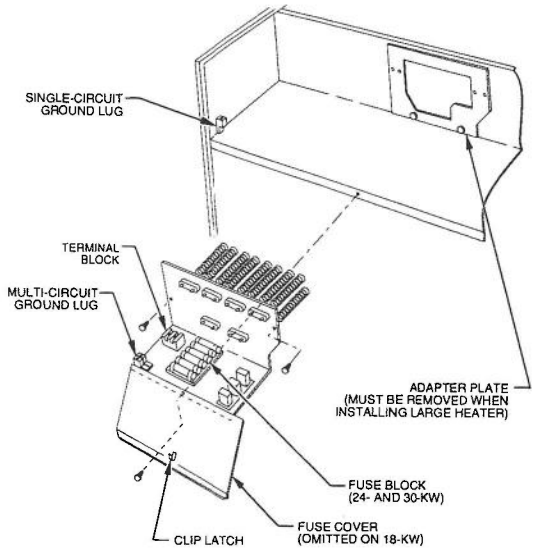
UNIT DAMAGE HAZARD.

Failure to follow this caution may result in property damage.

Before installation of heater, the black and yellow pigtail leads must be removed from the fan coil board or wire harness to prevent possible damage to the product. Electrical power will be provided to the board through the heater circuit plug.

3. Disconnect 2 power wires (black and yellow pigtail leads) from fan control board or wire harness (if applicable) and discard. Wires may be part of a plug assembly or attached to terminals L1 and L2. Remove cooling control plate from fan coil (if equipped). For 18kW, 24kW, and 30kW heaters, remove adapter plate. (See Figure 1)
4. Insert heater assembly into front of fan coil so that element rods engage holes in rear heat shield.
5. Attach heater control plate to fan coil using 2 screws provided. For 18kW, 24kW, and 30kW heater models, attach front of heater to fan deck using third screw. (See Figure 1)

Figure 1 | **Installing The Electric Heat Accessory**



Installation of 18kW, 24kW, and 30kW Model Heaters

Table 1 – Accessory Heater Usage

Part Number	Description	Use with Model Sizes
EHK05AKN	5 kW, single phase, no internal circuit protection	ALL
EHK05AKB	5 kW, single phase, with circuit breakers	ALL
EHK07AKN	8 kW, single phase, no internal circuit protection	ALL
EHK07AKB	8 kW, single phase, with circuit breakers	ALL
EHK09AKCN	9 kW, supplied as single phase, field convertible to 3-phase, no internal circuit protection	3600, 4800, 6000
EHK10AKN	10 kW, single phase, no internal circuit protection	ALL
EHK10AKB	10 kW, single phase, with circuit breakers	ALL
EHK15AKF	15 kW, single phase, with fuses	ALL
EHK15AKB*	15 kW, single phase, with circuit breakers	ALL†
EHK15AHN	15 kW, 3-phase, no internal circuit protection	ALL†
EHK18AHN	18 kW, 3-phase, no internal circuit protection	4800, 6000
EHK20AKF	20 kW, single phase, with fuses	ALL†
EHK20AKB*	20 kW, single phase, with circuit breakers	ALL†
EHK25AHCF	24 kW, supplied as 3-phase, field convertible to single phase, with fuses	4800, 6000
EHK30AHCF	30 kW, supplied as 3-phase, field convertible to single phase, with fuses	4800, 6000

* EHK15AKB & EHK20AKB are not approved for use in Canada (must use fused heaters and certified single point wiring kit).

† 15kW & 20kW are not recommended for specific heat pump applications, see AIRFLOW DELIVERY (CFM)

Minimum CFM when using Electric Heat (motor speed Low except as noted)

EBP, EBX, EBXX, EBW FEM, FSM, FSU Model Size	Heater kW								
	5	8	9	10	15	18	20	24	30
1800	525*	525*	–	600☆	–	–	–	–	–
2400	700‡	700‡	–	700‡	775‡	–	–	–	–
3000	875	875	–	875	875	–	1060*	–	–
3500 & 3600	1050	970	970	970	920	–	1040	–	–
4200	–	1225	1225	1225	1225	1225	1225	–	–
4800	–	1400	1400	1400	1400	1400	1400	1400	1400
6000	–	1750	1750	1750	1750	1750	1750	1750	1750

☆ Indicates High speed (Black wire) for 2-speed motor.

* Indicates Medium speed (Blue wire) for 3-speed motor or High speed (Black wire) for 2-speed motor

‡ Indicates Medium speed (Blue wire) for 3-speed motor or Low speed (Red wire) for 2-speed motor

STATIC PRESSURE CORRECTION FOR ELECTRIC HEATERS (EBP, EBW, EBX, EBXX, EBV, FEM, FSM, FSU, FVM)

Due to higher static pressure drop with additional electric heater elements in some application, an adjustment table to the static pressure is provided in the Installation and Operations Manual or the Product Specifications.

AIRFLOW DELIVERY (CFM)

EBV/FVM Model Size	Outdoor Unit Capacity (BTUH)	Electric Heater kW Range											
		0 – 5			0 – 10			0 – 15			0 – 20		
		LO	NOM	HI	LO	NOM	HI	LO	NOM	HI	LO	NOM	HI
2400	18	625	625	625	675	675	675	*	*	*	*	*	*
	24	650	725	835	*	725	835	875	875	875	*	*	*
	30	815	905	1040	*	905	1040	900	900	1040	1100	1100	1100
	36	980	1085	1250	980	1085	1250	980	1085	1250	1100	1100	1250
3600	24	675	725	835	875	875	*	*	*	*	*	*	*
	30	815	905	1040	875	905	1040	1100	1100	1100	*	*	*
	36	980	1085	1250	980	1085	1250	1100	1100	1250	1225	1225	1250
	42	1140	1270	1460	1140	1270	1460	1140	1270	1460	1225	1270	1460
		0 – 10			0 – 15			0 – 20			0 – 30		
4800	30	975	975	1040	1100	1100	1100	*	*	*	*	*	*
	36	980	1085	1250	1100	1100	1250	1250	1250	1250	*	*	*
	42	1140	1270	1460	1140	1270	1460	1250	1270	1460	*	*	*
	48	1305	1450	1665	1305	1450	1665	1305	1450	1665	1500	1500	1665
6000	36	1100	1100	1250	1350	1350	1350	*	*	*	*	*	*
	42	1140	1270	1460	1350	1350	1460	1525	1525	1525	*	*	*
	48	1305	1450	1665	1350	1450	1665	1525	1525	1665	1750	1750	1750
	60	1630	1810	2085	1630	1810	2085	1630	1810	2085	1750	1810	2085

* Airflow not recommended for heater/system size

NOTE: LO, NOM, and HI refer to AC/HP CFM ADJUST selection on the control board.

HEAT PUMP MINIMUM CFM WHEN USING ELECTRIC HEAT (CFM)

EBV/FVM Model Size	Outdoor Unit Size	Heater Size kW				
		5	8, 9, 10	15	18, 20	24, 30
2400	18	625	625	--	--	--
	24	650	725	875	--	--
	30	800	875	875	1040	--
	36	970	970	970	1040	--
3600	24	675	875	--	--	--
	30	800	875	1100	1150	--
	36	975	975	1100	1225	--
	42	1125	1125	1125	1225	--
4800	30	800	875	875	1150	--
	36	975	975	1100	1225	--
	42	1125	1125	1125	1225	--
	48	1305	1305	1305	1305	1400
6000	36	1100	1100	1350	1350	--
	42	1125	1125	1350	1350	--
	48	1300	1300	1350	1465	1750
	60	1625	1625	1625	1750	1750

A/C MINIMUM CFM WHEN USING ELECTRIC HEAT (CFM)

FVM Model Size		Heater Size kW				
		5	8, 9, 10	15	18, 20	24, 30
2400	Heater Only	625	625	725	875	--
3600		675	700	850	1050	--
4800		675	700	850	1050	1400
6000		1050	1050	1050	1050	1750

NOTES:

1. Heater Only–Air conditioner with electric heater application.
2. These airflows are minimum acceptable airflows as UL listed. Actual airflow delivered will be per airflow delivery chart for Electric Heating Modes.

PA5S
Single-Stage Split-System Air Conditioner with R-410A Refrigerant 1-1/2 To 5 Tons

Product Data

ITEM # 7

This unit has been designed utilizing R-410A refrigerant. The environmentally sound refrigerant allows you to make a responsible decision in the protection of the earth's ozone layer.

NOTE: Ratings contained in this document are subject to change at any time. Always refer to the AHRI directory (www.ahridirectory.org) for the most up-to-date ratings information.

Features / Benefits

Efficiency
- 13.8 - 16.0 SEER2 (14 - 16.5 SEER) / 11.2 – 13.0 EER2 (11.2 - 13.0 EER)
- Indoor air quality accessories available

Reliability
- R-410A refrigerant - environmentally sound, won't deplete the ozone layer and low lifetime service cost.
- Scroll compressor
- Internal pressure relief valve
- Internal thermal overload
- Filter drier

Durability
Protection Package:
- Solid, durable sheet metal construction
- Dense wire coil guard

Applications
- Long–line – up to 250 feet (76.20 m) total equivalent length, up to 200 feet (60.96 m) condenser above evaporator, or up to 80 ft. (24.4 m) evaporator above condenser (See Long Line Guide for more information.)
- Low ambient cooling (down to 0°F / -18°C) with approved low ambient accessory kits.

STANDARD FEATURES

Features	18	24	30	36	42	48	49	60	61
R-410A Refrigerant	X	X	X	X	X	X	X	X	X
SEER2 (Range depending on indoor combination)	14.3 - 16	14.3 - 16	14.3 - 16	14.3 - 16	13.8 - 15	13.8 - 15	14 - 16	13.8 - 15	14 - 16
Scroll Compressor	X	X	X	X	X	X	X	X	X
Field Installed Filter Drier	X	X	X	X	X	X	X	X	X
Front Seating Service Valves	X	X	X	X	X	X	X	X	X
Internal Pressure Relief Valve	X	X	X	X	X	X	X	X	X
Internal Thermal Overload	X	X	X	X	X	X	X	X	X
Long Line Capability	X	X	X	X	X	X	X	X	X
Low Ambient Capability with Kit	X	X	X	X	X	X	X	X	X

MODEL NUMBER NOMENCLATURE

1	2	3	4	5	6	7	8, 9	10	11	12
P	**A**	**5**	**S**	**A**	**N**	**4**	**24**	**0**	**0**	**W**
Branding	**OD Type**	**SEER2**	**OD Design Type**	**Major Series**	**Voltage**	**Refrigerant**	**Nominal Capacity**	**Feature**	**Special Feature**	**Region**
P = Sentry	A = AC	5 = 14.3 SEER2	S=Single-Stage	A-Z = Major Iteration	N = 208-230-1 or 208/230-1	4 = R410A	18 = 18,000 BTUH (1.5 Tons) 24 = 24,000 BTUH (2 Tons) 30 = 30,000 BTUH (2.5 Tons) 36 = 36,000 BTUH (3 Tons) 42 = 42,000 BTUH (3.5Tons) 48 = 48,000 BTUH (4 Tons) 49 = 48,000 BTUH (4 Tons) 60 = 60,000 BTUH (5 Tons) 61 = 60,000 BTUH (5 Tons)	0 = Standard	0 =Standard	W = Standard Southwest AC

CATALOG ORDERING NUMBERS

Size	Models
18	PA5SAN41800W
24	PA5SAN42400W
30	PA5SAN43000W
36	PA5SAN43600W
42	PA5SAN44200W
48	PA5SAN44800W
49	PA5SAN44900W
60	PA5SAN46000W
61	PA5SAN46100W

Use of the AHRI Certified TM Mark indicates a manufacturer's participation in the program For verification of certification for individual products, go to www.ahridirectory.org.

Quality ISO 9001

Physical Data

UNIT SIZE	18	24	30	36	42	48	49	60	61
Compressor Type	Scroll								
REFRIGERANT	R-410A								
Control	TXV R-410A Hard Shutoff								
Factory Charge lb (kg)*	4.7 (2.13)	5.6 (2.54)	6.6 (2.99)	6.8 (3.08)	8.1 (3.67)	8.1 (3.67)	12.4 (5.62)	10.1 (4.58)	14.5 (6.58)
COND FAN	Propeller Type, Direct Drive								
Air Discharge	Vertical								
Air Qty (CFM)	2050	2600	2575	3700	3890	3890	4090	4260	4320
Motor HP	1/12	1/10	1/10	1/4	1/4	1/4	1/3	1/4	1/3
Motor RPM	1100	1100	1100	1100	1100	1100	800	1100	800
COND COIL									
Face Area (Sq ft)	11.5	14.7	19.4	21.5	17.2	17.2	30.1	21.5	30.1
Fins per In.	25	25	25	25	20	20	20	20	20
Rows	1	1	1	1	2	2	2	2	2
Circuits	3	4	5	6	8	8	10	9	12
VALVE CONNECT. (In. ID)									
Vapor	3/4	3/4	3/4	7/8	7/8	7/8	7/8	7/8	7/8
Liquid	3/8"								
REFRIGERANT TUBES* (In. OD)									
Rated Vapor†	3/4	3/4	3/4	7/8	7/8	7/8	7/8	1-1/8	1-1/8
Rated Liquid Line‡	3/8"								

*.For 15 ft. lineset
†.Units are rated with 25 ft (7.6 m) of lineset length. See Vapor Line Sizing and Cooling Capacity Loss table when using other sizes and lengths of lineset.
‡.See Liquid Line Sizing For Cooling Only Systems with R-410A Refrigerant tables.
"--" = Factory charge and required charge values are equal
Note: See unit Installation Instruction for proper installation.

REFRIGERANT PIPING LENGTH LIMITATIONS

Liquid Line Sizing and Maximum Total Equivalent Lengths for Cooling Only Systems with R-410A Refrigerant:

The maximum allowable length of a residential split system depends on the liquid line diameter and vertical separation between indoor and outdoor units.

See Table below for liquid line sizing and maximum lengths :

Table 1 – Maximum Total Equivalent Length* Outdoor Unit BELOW Indoor Unit

Size	Liquid Line Connection	Liquid Line Diam. w/ TXV	AC with R-410A Refrigerant Maximum Total Equivalent Length†: Outdoor unit BELOW Indoor Vertical Separation ft (m)								
			0-5 (0-1.5)	6-10 (1.8-3.0)	11-20 (3.4-6.1)	21-30 (6.4-9.1)	31-40 (9.4-12.2)	41-50 (12.5-15.2)	51-60 (15.5-18.3)	61-70 (18.6-21.3)	71-80 (21.6-24.4)
18000	3/8	1/4	150	150	125	100	100	75	–	–	--
		5/16	250*	250*	250*	250*	250*	250*	250*	225*	150
		3/8	250*	250*	250*	250*	250*	250*	250*	250*	250*
24000	3/8	1/4	75	75	75	50	50	--	–	–	--
		5/16	250*	250*	250*	250*	250*	225*	175	125	100
		3/8	250*	250*	250*	250*	250*	250*	250*	250*	250*
30000	3/8	1/4	30	--	--	--	--	--	–	–	--
		5/16	175	225*	200	175	125	100	75	–	--
		3/8	250*	250*	250*	250*	250*	250*	250*	250*	250*
36000	3/8	5/16	175	150	150	100	100	100	75	–	--
		3//8	250*	250*	250*	250*	250*	250*	250*	250*	250*
42000	3/8	5/16	125	100	100	75	75	50	–	–	--
		3/8	250*	250*	250*	250*	250*	250*	250*	250*	150
48000	3/8	3/8	250*	250*	250*	250*	250*	250*	230	160	--
60000	3/8	3/8	250*	250*	250*	225*	190	150	110	–	--

*.Maximum actual length not to exceed 200 ft (61 m)
†.Total equivalent length accounts for losses due to elbows or fitting. See the Long Line Guideline for details.
-- = outside acceptable range

Table 2 – Maximum* Total Equivalent Length Outdoor Unit ABOVE Indoor Unit

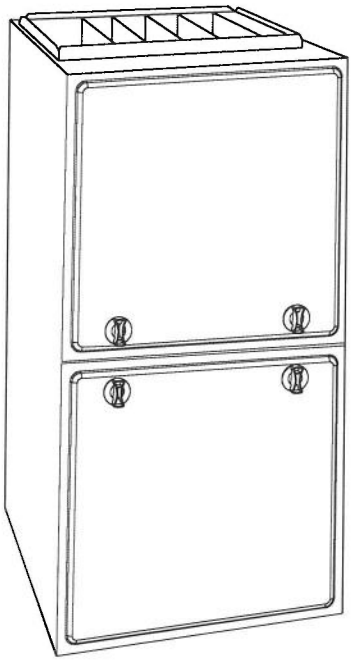
Size	Liquid Line Connection	Liquid Line Diam. w/ TXV	AC with R-410A Refrigerant Maximum Total Equivalent Length†: Outdoor unit ABOVE Indoor Vertical Separation ft (m)							
			25 (7.6)	26-50 (7.9-15.2)	51-75 (15.5-22.9)	76-100 (23.2-30.5)	101-125 (30.8-38.1)	126-150 (38.4-45.7)	151-175 (46.0-53.3)	176-200 (53.6-61.0)
18000	3/8	1/4	175	250*	250*	250*	250*	250*	250*	250*
		5/16	250*	250*	250*	250*	250*	250*	250*	250*
		3/8	250*	250*	250*	250*	250*	250*	250*	250*
24000	3/8	1/4	100	125	175	200	225*	250*	250*	250*
		5/16	250*	250*	250*	250*	250*	250*	250*	250*
		3/8	250*	250*	250*	250*	250*	250*	250*	250*
30000	3/8	1/4	30	--	--	--	--	--	--	--
		5/16	250*	250*	250*	250*	250*	250*	250*	250*
		3/8	250*	250*	250*	250*	250*	250*	250*	250*
36000	3/8	5/16	225*	250*	250*	250*	250*	250*	250*	250*
		3/8	250*	250*	250*	250*	250*	250*	250*	250*
42000	3/8	5/16	175	200	250*	250*	250*	250*	250*	250*
		3/8	250*	250*	250*	250*	250*	250*	250*	250*
48000	3/8	3/8	250*	250*	250*	250*	250*	250*	250*	250*
60000	3/8	3/8	250*	250*	250*	250*	250*	250*	250*	250*

*.Maximum actual length not to exceed 200 ft (61 m)
†.Total equivalent length accounts for losses due to elbows or fitting. See the Long Line Guideline for details.
-- = Outside acceptable range

PG95ESAA
35-IN. (889 MM) TALL
CONDENSING GAS FURNACE

Product Data

ITEM # 7



A11300

The PG95ESAA Multipoise Condensing Gas Furnace features a single-stage gas valve and a fixed-speeds, constant torque (FCT) ECM blower motor. With an Annual Fuel Utilization Efficiency (AFUE) of up to 96.0% this furnace provides added savings over standard gas furnaces. It features 4-way multipoise installation flexibility, and is available in ten model sizes. All sizes except the 26,000 BTUH model can be vented for direct vent/two-pipe, ventilated combustion air, or single-pipe applications. The 26,000 BTUH model can use the same 2-pipe venting system using outside air for combustion, but is not considered direct-vent. All sizes are design certified in Canada, and select sizes are certified for mobile/manufactured home use with conversion kit accessory.

PERFORMANCE

- Fixed-speeds, constant torque (FCT) ECM blower motor for electrically efficient operation all year long in heating, cooling and continuous fan operation.
- Single-speed inducer motor, and single-stage gas valve
- Silicon Nitride Hot Surface Igniter.
- Adjustable blower speed for heating and cooling.
- Aluminized-steel primary heat exchanger.
- Stainless-steel condensing secondary heat exchanger.

INSTALLATION FLEXIBILITY

- 4-way multipoise design for upflow, downflow or horizontal installation, with unique vent elbow and optional through-the-cabinet downflow venting capability.
- Factory-configured ready for upflow applications.
- Ideal height 35" (889 mm) cabinet: short enough for taller coils, but still allows enough room for service.
- Two-pipe venting, single-pipe venting or ventilated combustion air.

APPLICATIONS

- Approved for Twinning applications with accessory kit (42060B through 60100C models, only).
- Approved for Manufactured Housing/Mobile Home applications with MH accessory kit. (30040A through 66120D models, only).
- Propane convertible with gas conversion accessory kit.

CERTIFICATIONS

- All sizes meet ENERGY STAR® Version 4.1 criteria for gas furnaces: 95%+ AFUE.
- Cabinet air leakage less than 2.0% at 1.0 in. W.C. and cabinet air leakage less than 1.4% at 0.5 in. W.C. when tested in accordance with ASHRAE standard 193.
- All sizes meet 40 ng/J NOx emissions. Can be installed in air quality management districts with a 40 ng/J NOx emissions requirement

Certified System
ISO 9001
Quality

AHRI CERTIFIED

Use of the AHRI Certified ™ Mark indicates a manufacturer's participation in the program. For verification of certification for individual products, go to www.ahridirectory.org.

DESIGN CERTIFIED

CERTIFIED

FACTORY AUTHORIZED PARTS

FURNACE	CASING DIMENSIONS (IN.)			RATED HEATING OUTPUT† BTUH	AFUE		ENERGY STAR®	HEATING AIRFLOW		COOLING CFM @ 0.5 ESP (in. W.C.)	MOTOR HP SPEED - TAPS
	H	D	W		UPFLOW/ HORIZON-TAL	DOWN-FLOW		HEATING CFM‡	HEATING ESP (in. W.C.)		
PG95ESAA30026A	35	29.50	14.20	25,000	96.0%	95.0%	YES	605	0.10	895	1/3 - 5
PG95ESAA30040A	35	29.50	14.20	39,000	96.0%	95.0%	YES	695	0.10	950	1/2 - 5
PG95ESAA36040B	35	29.50	17.50	39,000	96.0%	95.0%	YES	650	0.10	1010	1/2 - 5
PG95ESAA36060A	35	29.50	14.20	58,000	95.0%	95.0%	YES	930	0.12	1120	1/2 - 5
PG95ESAA42060B	35	29.50	17.50	58,000	96.0%	95.0%	YES	1010	0.12	1330	3/4 - 5
PG95ESAA48080B	35	29.50	17.50	78,000	96.0%	95.0%	YES	1325	0.12	1665	3/4 - 5
PG95ESAA60080C	35	29.50	17.50	78,000	96.0%	95.0%	YES	1330	0.12	1855	1 - 5
PG95ESAA60100C	35	29.50	21.00	97,000	96.0%	95.0%	YES	1730	0.15	2125	1 - 5
PG95ESAA66120D	35	29.50	24.00	116,000	96.0%	95.0%	YES	2020	0.20	2105	1 - 5
PG95ESAA66140C	35	29.50	24.00	135,000	95.0%	95.0%	YES	2130	0.20	2310	1 - 5

† Capacity in accordance with DOE test procedures. Ratings are position dependent. See rating plate.
‡ Heating CFM at factory default blower motor heating tap settings.
ESP – External Static Pressure

FEATURES AND BENEFITS

Dual Fuel System — This system can provide more control over your monthly energy bills by automatically selecting the most economical method of heating. Our system automatically switches between the gas furnace and the electric heat pump as outside temperatures change to maintain greater efficiency and comfort than with any traditional single-source heating system. The heat pump also delivers high-efficiency cooling in the summer.

Robust Igniter — Payne's unique SiN igniter is not only physically robust but it is also electrically robust. It is capable of running at line voltage and does not require complex voltage regulators as do other brands. This unique feature further enhances the gas furnace reliability and continues Payne's tradition of technology leadership and innovation in providing a reliable and durable product.

ECM Blower Motor — This basic ECM, or electronically commutated motor, can provide an efficiency enhancement for select Payne air conditioner or heat pump systems. It uses less electrical power than its PSC counterpart and also has a wider range of speeds

Reliable Heat Exchanger Design — The aluminized steel, clam shell primary heat exchanger was re-engineered to achieve greater efficiency out of a smaller size. The first two passes of the heat exchanger are based on the current 80% product, a design with more than ten years of field-proven performance and success. These innovations, paired with the continuation of a crimped, no-weld seam create an efficient, robust design for this essential component.

The condensing heat exchanger, a stainless steel fin and tube design, is positioned in the furnace to extract additional heat. Stainless steel coupling box componentry between heat exchangers has exceptional corrosion resistance in both natural gas and propane applications.

Media Filter Cabinet — Enhanced indoor air quality in the home is made easier with our media filter cabinet—accessory (purchased separately). When installed as a part of the system, this cabinet allows for easy and convenient addition of a Payne high efficiency air filter.

4-Way Multipoise Design — One model for all applications – there is no need to stock special downflow or horizontal models when one unit will do it all.

Direct or Single-pipe Venting, or Optional Ventilated Combustion Air — All sizes except the 26,000 BTUH model can be vented for direct vent/two-pipe, ventilated combustion air, or single-pipe applications. The 26,000 BTUH model can use the same 2-pipe venting system using outside air for combustion, but is not considered direct-vent.

Sealed Combustion System — This furnace brings in combustion air from outside the furnace, which results in especially quiet operation. By sealing the entire combustion vestibule, the entire furnace can be made quieter, not just the burners.

Insulated Casing — Foil-faced insulation in the heat exchanger section of the casing minimizes heat loss.

Monoport Burners — The burners are specially designed and finely tuned for smooth, quiet combustion and economical operation.

Bottom Closure — Factory-installed for side return; easily removable for bottom return. The multi-use bottom closure can also serve for roll-out protection in horizontal applications, and act as the bottom closure for the optional return air base accessory.

Blower Access Panel Switch — Automatically shuts off 115-v power to furnace whenever blower access panel is opened.

Quality Registration — Our furnaces are engineered and manufactured under a quality management system registered to ISO 9001.

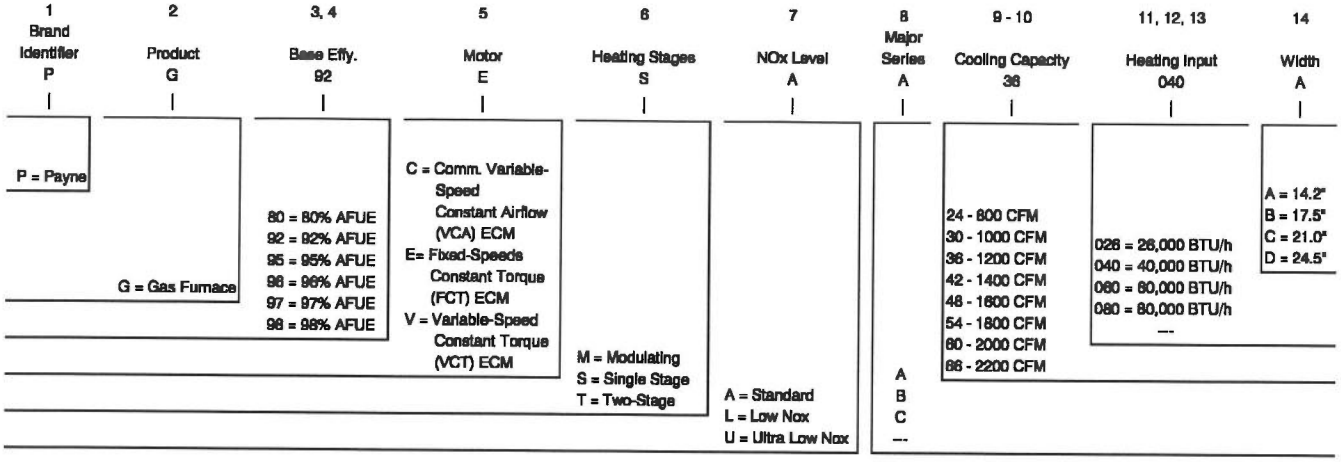
SPECIFICATIONS

The furnace should be sized to provide 100 percent of the design heating load requirement plus any margin that occurs because of furnace model size capacity increments. None of the furnace model sizes can be used if the heating load is 12,000 BTUH or lower. Use Air Conditioning Contractors of America (Manual J and S); American Society of Heating, Refrigerating, and Air-Conditioning Engineers; or other approved engineering method to calculate heating load estimates and select the furnace. Excessive oversizing of the furnace may cause the furnace and/or vent to fail prematurely, customer discomfort and/or vent freezing.

Failure to follow these guidelines is considered faulty installation and/or misapplication of the furnace; and resulting failure, damage, or repairs may impact warranty coverage.

Heating Capacity and Efficiency		30026A	30040A	36040B	36060A	42060B	48080B	60080C	60100C	66120D	66140D
Input	High Heat (BTUH)	26,000	40,000	40,000	60,000	60,000	80,000	80,000	100,000	120,000	140,000
Output	High Heat (BTUH)	25,000	39,000	39,000	58,000	58,000	78,000	78,000	97,000	117,000	135,000
Certified Temperature Rise Range °F (°C)	High Heat	25 - 55 (14 - 31)	40 - 70 (22 - 39)	40 - 70 (22 - 39)	45 - 75 (25 - 42)	40 - 70 (22 - 39)	40 - 70 (22 - 39)	40 - 70 (22 - 39)	40 - 70 (22 - 39)	40 - 70 (22 - 39)	45 - 75 (25 - 42)
Airflow Capacity and Blower Data											
Rated External Static Pressure (in. w.c.)	Heating	0.10	0.10	0.10	0.12	0.12	0.12	0.12	0.15	0.20	0.20
	Cooling	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Airflow Delivery @ Rated ESP (CFM)	High Heat	605	695	650	930	1010	1325	1330	1730	2020	2130
	Cooling	895	950	1010	1120	1330	1665	1855	2125	2105	2310
Cooling Capacity (tons) @ CFM/ton	400 CFM/ton	2	2	2.50	2.50	3.50	4	5	5	5	5
	350 CFM/ton	2.50	2.50	3	3	4	4.50	5.50	6	6	6
Direct-Drive Motor Type		Electronically Commutated Motor (ECM)									
Direct-Drive Motor HP		1/3	1/2	1/2	1/2	3/4	3/4	1	1	1	1
Motor Full Load Amps		4.4	6.3	6.8	6.3	8.8	9.2	11.5	11.7	11.5	11.7
RPM Range		400 - 1200	600 - 2000	400 - 1200	600 - 2000	400 - 1200	400 - 1200	400 - 1200	400 - 1200	400 - 1200	400 - 1200
Speed Selections		5	5	5	5	5	5	5	5	5	5
Blower Wheel Dia x Width	in.	11 x 7	11 x 7	11 x 8	11 x 7	11 x 8	11 x 8	11 x 10	11 x 10	11 x 11	11 x 11
Air Filtration System		Field Supplied Filter									
Filter Used for Certified Watt Data		KGAWF**06UFR									
Electrical Data											
Input Voltage	Volts-Hertz-Phase	115-60-1									
Operating Voltage Range	Min-Max	104-127									
Maximum Input Amps	Amps	5.1	7.0	7.5	7.1	9.6	10	12.3	12.6	12.4	12.6
Unit Ampacity	Amps	7.3	9.7	10.3	9.8	12.9	13.4	16.3	16.7	16.4	16.7
Minimum Wire Size	AWG	14	14	14	14	14	14	12	12	12	12
Maximum Wire Length@ Minimum Wire Size	Feet	50	38	36	38	28	27	35	34	35	34
	(M)	(15.5)	(11.7)	(10.9)	(11.5)	(8.7)	(8.4)	(10.7)	(10.5)	(10.7)	(10.5)
Maximum Fuse/Ckt Bkr (Time-Delay Type Recommended)	Amps	15	15	15	15	15	15	20	20	20	20
Transfomer Capacity (24vac output)		40 VA									
External Control Power Available	Heating	27.9 VA									
	Cooling	34.6 VA									
Controls											
Gas Connection Size		1/2" - NPT									
Burners (Monoport)		2	2	2	3	3	4	4	5	6	7
Gas Valve (Redundant)	Manufacturer	White Rodgers									
Minimum Inlet Gas pressure (in. wc)		4.50									
Maximum Inlet Gas pressure (in. wc)		13.60									
Manufactured (Mobile) Home Kit		See Accessory Listing									
Ignition Device		Silicon Nitride									
Heating Blower Control (Heating Off-Delay)		Adjustable: 90, 120, 150, 180 seconds									
Cooling Blower Control (Time Delay Relay)		90 seconds									
Communication System		*none*									
Thermostat Connections		Com 24V, R, W, G, Y									
Accessory Connections		EAC (115vac); HUM (24vac); 1-stg AC (via Y)									

MODEL NUMBER NOMENCLATURE

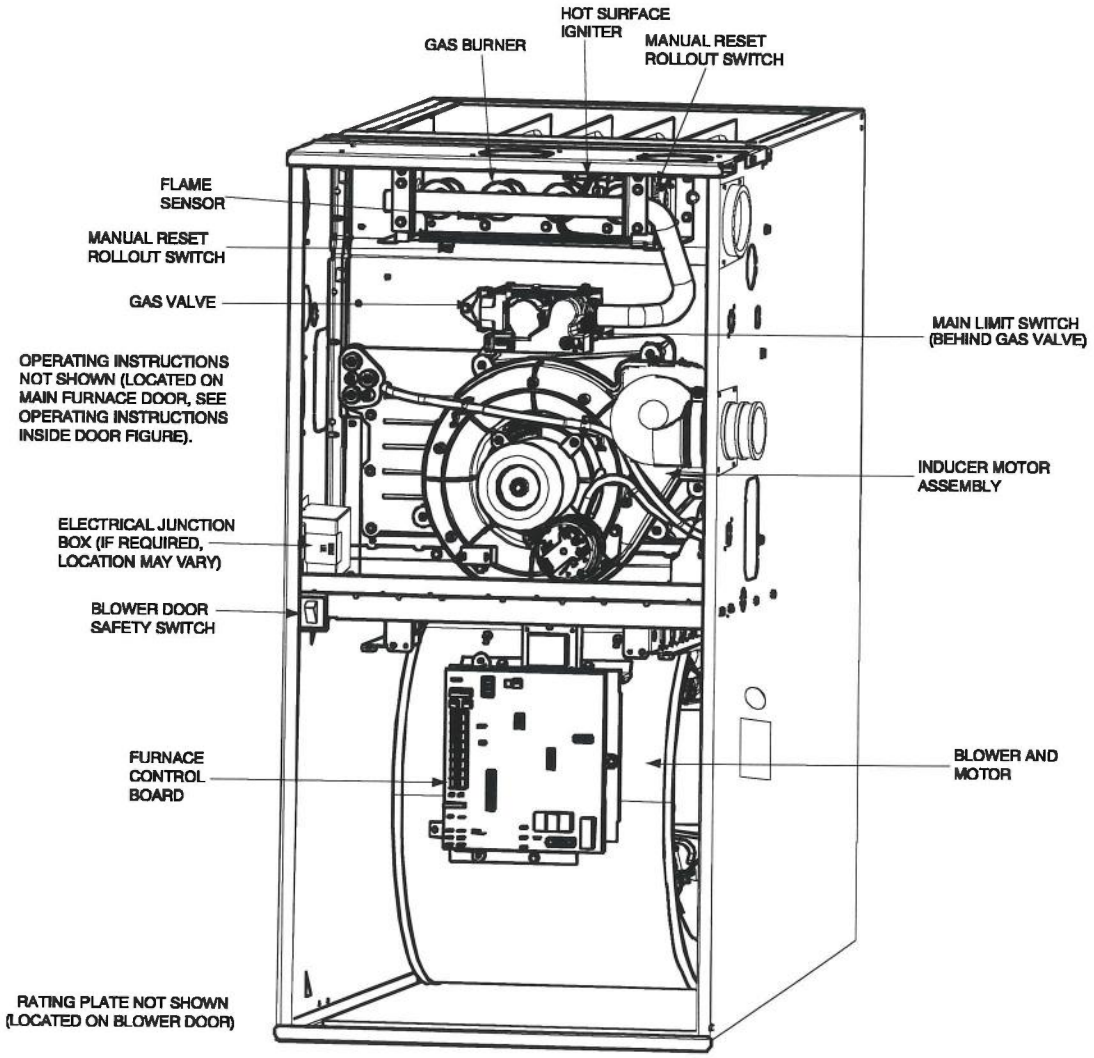


A180306

For California Residents:

For installation in SCAQMD only: This furnace does not meet the SCAQMD Rule 1111 14 ng/J NOx emission limit, and thus is subject to a mitigation fee of up to $450. This furnace is not eligible for the Clean Air Furnace Rebate Program: www.CleanAirFurnaceRebate.com

FURNACE COMPONENTS



A190145

Advanced Distributor Products®

ITEM # 7

SG-HE-04
March 2019

Specification Guide

HE Series

Evaporator Coils

Contents **Page**

AHRI CERTIFIED

c UL us

HealthySolutions®

PROTECTION THAT LIVES ON MICROBAN®

2175 West Park Place Blvd., Stone Mountain, GA 30087
www.adpnow.com

HE Series – Product Features

- High efficiency lanced fin design
- "No-hassle" 5 year warranty.
- R-22, R-410A, AC & Heat Pump compatible.
- All coils have durable packaging with bar coded labels on the box.
- Threaded expansion valves available factory installed or as a field installed kit.
- Coils are air pressure tested at 500 psi, leak tested with helium, sealed with rubber plugs, then charged with dry air.
- Piston options include externally accessible body for easy piston change out and/or TXV installation.
- Microban® antimicrobial additive to inhibit the growth of mold and mildew in the drain pan.
- UV resistant drain pans are molded of high temperature (450 deg. F) engineered polymer.
- Dual 3/4" FPT condensate drains on front-left and front-right side of drain pans.
- Patented HydroTEC™ low water retention drain pan.
- Copper refrigerant connections for easy brazing on both copper and aluminum slab models.
- Intertek lab tested 1% or less cabinet air leakage for better efficiency.
- Cased coil cabinets are fully lined with 5/8" foil faced insulation.
- Optional painted or embossed galvanized steel cabinets.
- Short cabinet with easy access.
- Non-captive refrigerant lines with long stubs make for easy installation.
- Enhanced refrigerant pipe grommets: secure, tight, and easy to install.
- Copper distributor tube assembly provides brass to brass threads for trouble-free service of TXV.
- Expansion valve with improved temperature sensing:
    1.) Mounted inside cabinet to prevent external sweating
    2.) Bulb clamped standard factory installed
- All multi-position coils are upflow, downflow, and left or right airflow capable.
- Cabinet insulation hold down tabs for easy drain pan removal.
- Interlocking doors reduce air leakage and allow for easy access.
- Foam drain seal for reduced air leakage.
- All multi-position coils are field convertible from horizontal right-to-left airflow and horizontal left-to-right airflow.
- Suction line refrigerant connections are 3/4" ODF (A-Coil 18-36 size models) or 7/8" ODF (A-Coil 42-60 size models)
- Suction line refrigerant connections are 1.125" on slab numbers E43, E46, E56, and E65 for size 42 models and higher.
- Corrosion resistant coil header plates.
- All A-Coils are upflow or downflow capable.

WARNING—Face velocity above 350 ft/min. is not recommended for downflow or counterflow applications due to potential water blow-off.

HE Series – Nomenclature

H G30 2 24 D 145 B 12 05 AP

Cabinet Color
- **H** = Embossed
- **A** = Armstrong
- **D** = Ducane/Aire-Flo
- **G** = ICP
- **J** = Goodman/Amana
- **L** = Lennox
- **N** = Nordyne
- **P** = Carrier/Bryant/Payne
- **R** = Rheem/Ruud
- **T** = Trane/American Std.
- **Y** = York/Luxaire/Coleman

Slab Number
- **E & A** = Copper slab
- **G** = Aluminum slab

Metering Device [1]
- **1** = Piston (R-410A)
- **2** = Piston (R-22)
- **6** = Non-bleed A/C TXV (R-410A)
- **7** = Bleed HP-A/C TXV (R-410A)
- **8** = Bleed A/C TXV (R-410A)
- **9** = Non-bleed HP-A/C TXV (R-410A)

Nominal MBTUH

Cabinet Depth [2]
- **A** = Uncased
- **C** = 20.5"
- **D** = 21.0"
- **E** = 21.5"

Width

Cased	*Uncased*
140 = 14"	**130** = 13"
142 = 14.25"	**140** = 14"
145 = 14.5"	**155** = 15.5"
175 = 17.5"	**170** = 17"
210 = 21"	**200** = 20"
245 = 24.5"	**205** = 20.5
255 = 25.5"	**235** = 23.5"
	251 = 25.1"

Cabinet Upper Notch
- **A** = Uncased
- **B** = .75" (standard)

Cabinet Height [6]
- **00** = Uncased
- **12** = 12.5"
- **16** = 16.5"
- **18** = 18.5" (up to 31.5")

Product Code [5]
- **00** = Right-hand uncased
- **01** = Right-hand cased
- **04** = Left-hand uncased
- **05** = Left-hand cased
- **20** = Right-hand cased multi-position
- **22** = Left-hand cased multi-position

Piston Size [3]

AP = TXV access port [4]

MBTUH	R-22	R-410A
12 =	41	41
18 =	53	49
24 =	59	53
30 =	67	59
36 =	73	67
42 =	80	73
48 =	84	76
60 =	93	93

[1] 7 and 8 valve options available only for York family products.
[2] C-depth not available for aluminum slabs.
[3] Piston will always be sized to match the nominal BTU rating of the coil.
[4] TXV access port standard on factory installed TXVs; optional on piston models.
[5] Refrigerant connections and exposed drain connections are both on the left or right side as indicated.
[6] Cabinet height not a selectable option, see cased dimensions.

ITEM # 8

Airtemp

Submittal: GDH09(2.6)FMK4DH — Flex Match Ducted Indoor Unit

Features:

- -Inverter-driven Variable Speed Blower
- -Flared Piping Connections
- -Wireless Remote Controller Included
- -Wired Rmote Controller Included
- -Built-in Condensate Lift Pump
- - Air Filters Included
- -Intelligent Pre-Heat
- -Child Lock Function
- -Configurable Return (Rear & Bottom)

Indoor Unit Data

Blower:

CFM (Max/Min):	264/147
Output (W):	40
FLA:	0.280
Capacitor Rating (µF):	1.5

Sound Pressure

Cooling dB (A) (Min/Max):	31/37

Physical Characteristics

Net Weight (lbs):	48.51
Dimensions (in.)	
W:	27.6
D:	24.2
H:	7.9

Piping Connection Size

"Liquid":	1/4"
Gas:	3/8"

Dimensions

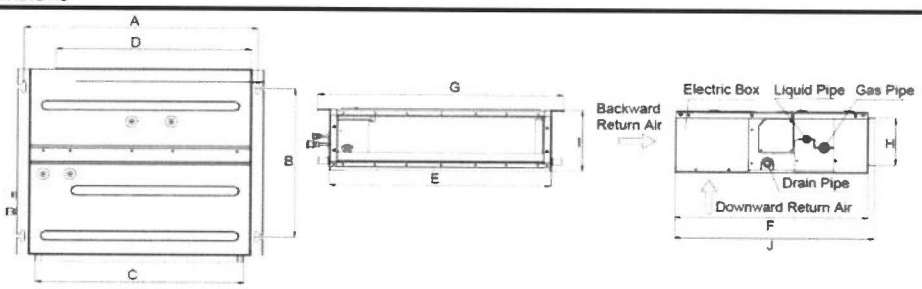
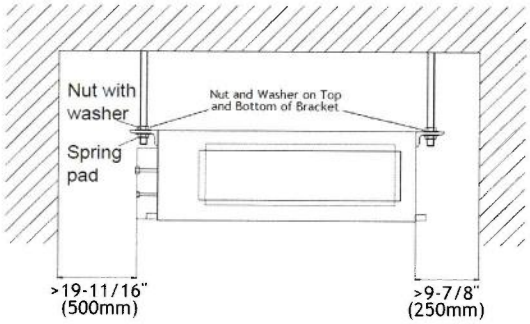


Table 1: Outline Dimensions: mm (in)

Item / Model	A	B	C	D	E	F	G	H	I	J
GDH09(2.6)FMK4DH	742 (29-3/16)	491 (19-5/16)	662 (26-1/16)	620 (24-7/16)	700 (27-9/16)	615 (24-3/16)	782 (30-13/16)	156 (6-1/8)	200 (7-7/8)	635 (25)
GDH12(3.5)FMK4DH										
GDH18(5.3)FMK4DH	942 (37-1/16)	491 (19-5/16)	862 (33-15/16)	820 (32-5/16)	900 (35-7/16)	615 (24-3/16)	982 (38-11/16)	156 (6-1/8)	200 (7-7/8)	635 (25)
GDH21(6.2)FMK4DH	1142 (44-15/16)	491 (19-5/16)	1062 (41-13/16)	1020 (40-3/16)	1100 (43-5/16)	615 (24-3/16)	1182 (49-9/16)	156 (6-1/8)	200 (7-7/8)	635 (25)
GDH24(7.0)FMK4DH										

Clearances



IDU SKU: 1009428

ITEM # 8

Airtemp

R410-A | Inverter | Intertek | 3DC

Submittal: GHH09(2.6)LUK4DH — Flex Match Wall Mount

Features:

- -Inverter-driven Variable Speed Blower
- -Flared Piping Connections
- -Wireless Remote Controller Included
- -Anti-corrosion coils
- -iFeel Operation
- -Air Filters Included
- -Turbo Cooling
- -Child Lock Function

Indoor Unit Data

Blower:

CFM (Max/Min):	376/170
Output (W):	20
RLA:	0.090
Capacitor Rating (μF):	N/A

Sound Pressure

Cooling dB (A) (Min/Max):	29/43

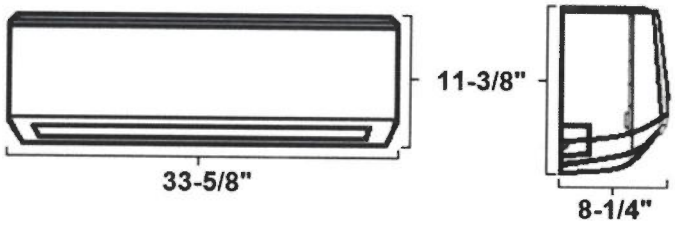
Physical Characteristics

Net Weight (lbs):	22.05
Dimensions (in.)	
W:	33.268
H:	11.378
D:	8.228

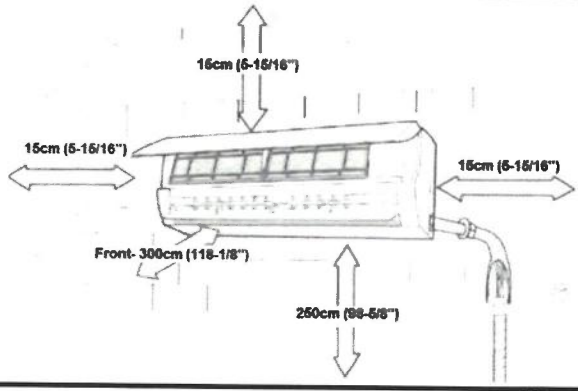
Piping Connection Size

"Liquid":	1/4"
Gas:	3/8"

Dimensions



Clearances



IDU SKU: 1007899

TECHNICAL SPECIFICATIONS

ITEM # 8

Flex Match Series

GKH(_)(_)FMK4DH1
Up to 21 SEER2, 10.0 HSPF2
Cassette Indoor Unit

12K – 24K BTUH Capacity

FEATURES and BENEFITS

- **Inverter Driven Blower** – State-of-the-art inverter driven technology that offers wide range of modulation
- **Flared Piping Connections** – Ensures easy and quick installation
- **Wireless Remote Controller** – Remote include in all multi-zone indoor units
- **Anti-Corrosion Coils** – Blue fin coatings improves the heating efficiency, accelerates defrost, and adds significant resistance to corrosive elements
- **iFeel Operation** – Mini sensor in the remote control can sense its surrounding temperature and transmit the signal back to the indoor unit
- **Air Filters** – Included with indoor unit
- **Turbo Cooling** – Button on the remote control to enjoy increased airflow, which enables the indoor temperature to reach set temperature in a shorter time
- **Condensate Pump** – Internal condensate pump included in each unit
- **4-Way Discharge** – Discharge vents located on each side of the unit to provide even air delivery to the space
- **Auto Swing** – Horizontal auto swing option available
- **Decorative Discharge Grille** – Provided with each unit

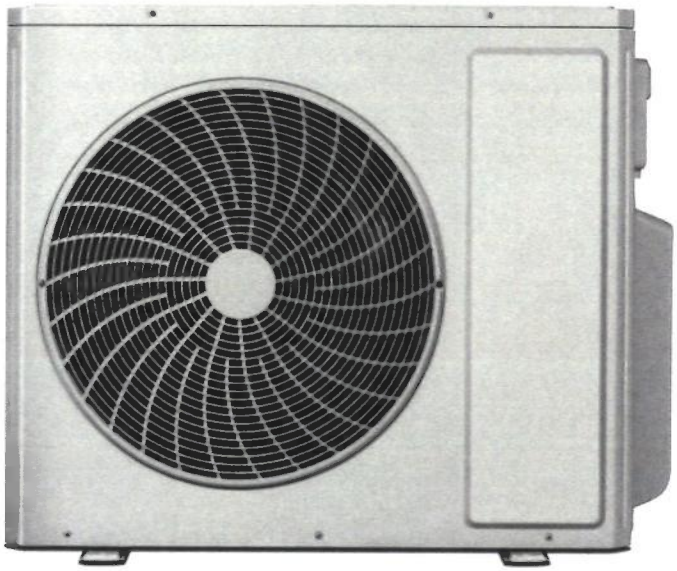
TECHNICAL SPECIFICATIONS

ITEM # 8

Flex Match Series

GXH(_)(_)FMK4DH-1
Up to 21 SEER2, 10.0 HSPF2
Multi-Zone Heat Pump

18K – 42K BTUH Capacity



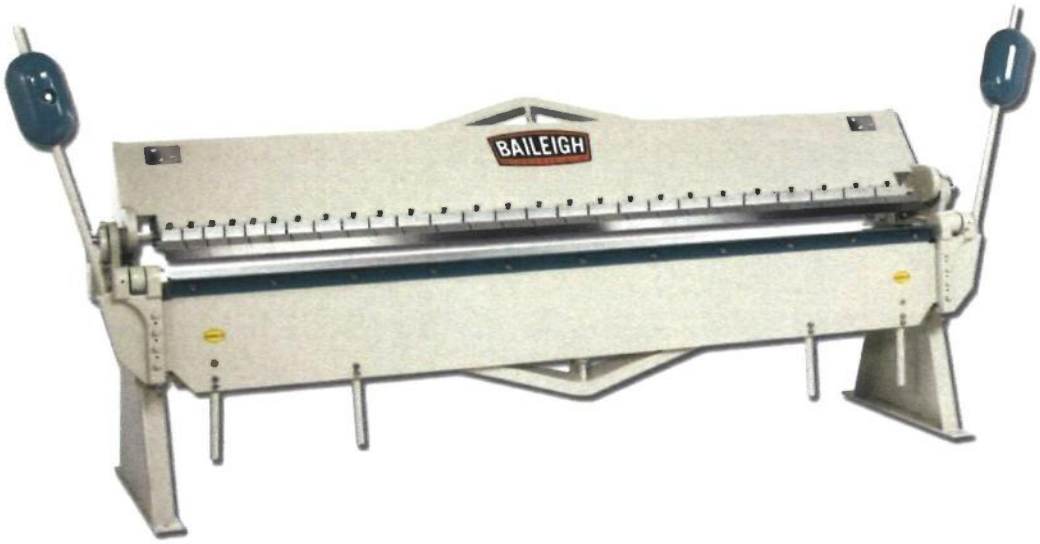
FEATURES and BENEFITS

- **Inverter Driven Compressor and Fan** – State-of-the-art inverter driven technology that offers wide range of modulation
- **Flared Piping Connections** – Ensures easy and quick installation.
- **Wireless Remote Controller** – Remote include in all multi-zone indoor units
- **Anti-Corrosion Coils** – Blue fin coatings improves the heating efficiency, accelerates defrost, and adds significant resistance to corrosive elements
- **Intelligent Defrost** – Intelligent Defrosting is only performed when needed, which reduces energy waste by eliminating the unnecessary defrosting process
- **Base Pan Heater** – prevents freezing and improves heating efficiency during low temperature operation

ITEM # 9

Sheet Metal Brake | BB-12014

Product Images



Short Description

Sheet Metal Brake - (BB-12014)

Additional Information

Stock Number	BA9-1000361
Beam Adjustment (Front to Rear) (In.)	1"
Maximum Box Depth (In.)	6"
Mild Steel Capacity (Gauge)	14.0000
Model Number	BB-12014
Prop 65	Cancer and Reproductive Harm
Style (Type)	Box and Pan Brake
Weight (Lbs.)	3950
Shipping Dimensions (L x W x H) (In.)	145x33x45
Input Power	Manual
Max. Bend (Deg.)	0 – 135°
Overall Length (In.)	120"
Product Lease Price	432

ITEM # 9

Lock Former Pittsburgh Machine - (LF-20)

Product Images

Short Description

Lock Former Pittsburgh Machine - (LF-20)

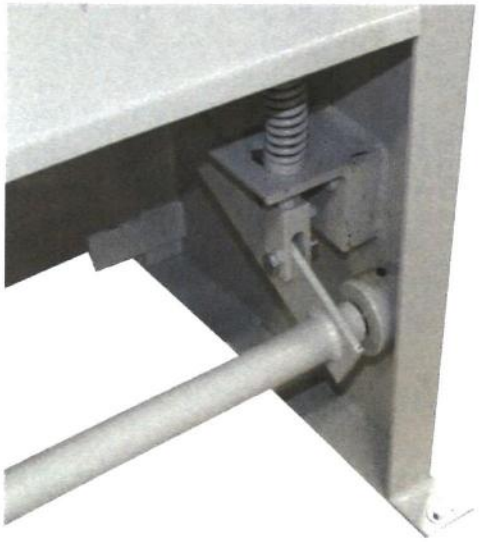
Additional Information

Stock Number	BA9-1004984
Model Number	LF-20
Prop 65	Cancer and Reproductive Harm
Weight (Lbs.)	410
Product Lease Price	154

ITEM # 9

Manual Foot Shear - (SF-5216)

Product Images



Additional Information

Stock Number	BA9-1007017
Front Gauge Capacity (In.)	24
Model Number	SF-5216
Prop 65	Cancer and Reproductive Harm
Shearing Length Capacity (In.)	52"
Style (Type)	Manual Foot Shear
Weight (Lbs.)	1060
Product Lease Price	169

ITEM # 11 581701-CTG-D-0420

TECHNICAL GUIDE

LX SERIES
SPLIT SYSTEM
AIR CONDITIONERS
14 SEER – R-410A – 1 PHASE
1.5 THRU 5 NOMINAL TONS
MODELS: TC4B18 THRU 60

AHRI CERTIFIED www.ahridirectory.org Unitary Small AC AHRI Standard 210/240

ISO 9001 Certified Quality Management System

AMERICAN QUALITY DESIGNED, ENGINEERED & ASSEMBLED IN THE USA

Due to continuous product improvement, specifications are subject to change without notice.

Visit us on the web at
www.simplygettingthejobdone.com and
www.colemanac.com

Additional rating information can be found at
www.ahridirectory.org

WARRANTY SUMMARY*

Standard 5-Years limited parts warranty.

Standard 10-Years limited compressor warranty.

Extended 10-Years limited parts warranty when product is registered online within 90 days of purchase for replacement or closing for new home construction.

*Does not apply to R-22 models, 3-Phase models, or Internet sales.
See Limited Warranty certificate in User's Information Manual for details.

DESCRIPTION

The TC4B models are part of our successful 14 SEER Regional Minimum Efficiency in the Southeast US, these outdoor units are specifically designed to be matched with York indoor coils, furnaces, and air handlers to provide a complete system solution.

FEATURES

- **Small Footprint** - Minimum footprint for easier handling, transportation, and installation.
- **Easier Installation** - Independent panels provide quick access for unit setup. Installation time is reduced by easy power and control wiring access. Select indoor matches with factory-mounted TXVs are available for quicker system installation. The factory installed filter-drier and factory charge for a 15-Ft lineset means less time spent brazing and charging the system. The small base dimension and reduced unit clearances make for easier retrofits.
- **Accessible Information** - QR code on unit provides quick access to technical documents and warranty information.
- **Durable Finish** - The coated steel wire fan guard, coated external fasteners, and pre-treated G90-equivalent galvanized steel chassis components resist corrosion and rust creep. Titanium colored powdercoat paint further protects external panels.
- **Quality Coils** - The high efficiency microchannel aluminum coil is manufactured using an improved material system providing reliable performance and small unit size.
- **Rugged Coil Protection** - Coils are protected from mechanical damage by a proven stamped steel coil guard design.
- **Protected Compressor** - Compressors are protected internally by a high pressure relief valve and a temperature sensor, and externally by the system high pressure switch. The liquid line filter-drier is factory installed to protect the compressor against moisture and debris.
- **Reliable Operation** - Ball bearing fan motors provide superior performance in extreme temperatures.
- **Environmentally Friendly** - CFC-free R-410A refrigerant delivers environmentally friendly performance with zero ozone depletion.
- **Top Discharge** - Warm air is blown up, away from the structure and any landscaping and allows compact location on multi-unit applications.
- **Low Operating Sound Levels** - Developed using CFD and FEA tools, the sturdy cabinet and top design provides sound performance of 76 dBA or lower. Compatible accessories for further sound reduction are also available.
- **Better Service Access** - Diagonal base valves with open access for low-loss fittings, single panel access to the electrical controls, swing out control box for full corner access, and removable fan guard allow easy access for unit maintenance.
- **Agency Listed** - Safety certified by CSA to UL 1995 / CSA 22.2. Performance certified to ANSI/AHRI Standard 210/240 in accordance with the Unitary Small Equipment certification program.

ITEM # 11

5129600-CTG-E-1219

TECHNICAL GUIDE

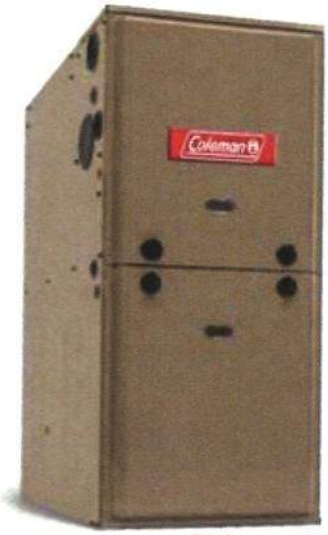
96% AFUE TWO STAGE STANDARD ECM RESIDENTIAL GAS FURNACES

MULTI-POSITION

MODELS: TM9Y

NATURAL GAS

40 - 120 MBH INPUT



Due to continuous product improvement, specifications are subject to change without notice.

Visit us on the web at
***www.simplygettingthejobdone.com* and**
www.colemanac.com

Additional rating information can be found at
www.ahridirectory.org

WARRANTY SUMMARY

A 20-year limited warranty on heat exchangers in residential applications.

A 10-year warranty on the heat exchanger in commercial applications.

Standard 5-year limited Parts warranty.

Extended residential limited lifetime heat exchanger and 10-year limited parts warranty when product is registered online within 90 days of purchase for replacement or within 90 days of closing for new home construction.

See Limited Warranty certificate in Users Information Manual for details.

DESCRIPTION

These Coleman® compact units employ induced combustion, reliable hot surface ignition and high heat transfer aluminized steel tubular primary heat exchangers. The units are factory shipped for installation in upflow or horizontal applications and may be converted for downflow applications.

These furnaces are designed for residential installation in a basement, closet, alcove, attic, recreation room or garage and are also ideal for commercial applications. All units are factory assembled, wired and tested to assure safe dependable and economical installation and operation.

These units are Category IV, National Fuel Gas Code and may be vented either through side wall or roof applications using approved plastic combustion air and vent piping. Approved plastic combustion air and vent piping include Selkirk Polyflue, Duravent Polypro, & Centrotherm Innoflue polypropylene venting systems.

FEATURES

- Two stage heating operation includes two stage gas valve, two stage inducer operation and constant torque standard ECM blower operation. Adjustable delay timer allows two stage operation with a single stage thermostat.
- Easily applied in upflow, horizontal left or right, or downflow installation with minimal conversion necessary.
- Compact, easy to install, ideal height 33" tall cabinet.
- Standard ECM constant torque drive for cooling SEER enhancement, improved comfort with optional airflow delay profiles, and continuous fan options for IAQ performance.
- Easy access to controls to connect power/control wiring.
- Built-in, high level self diagnostics with fault code display.
- Low unit current draw requirement for easy replacement application.
- All models are convertible to use propane (LP) gas.
- Electronic Hot Surface Ignition saves fuel use with increased dependability and reliability.
- 100% shut off main gas valve for extra safety.
- 24V, 40 VA control transformer and integrated furnace control supplied for add-on cooling.
- Hi-tech tubular aluminized steel primary heat exchanger with stainless steel tube/aluminum fin secondary heat exchanger for outstanding efficiency.
- Solid removable bottom panel allows easy conversion.
- Airflow leakage less than 1% of nominal airflow for duct blaster conditions.
- No knockouts to deal with, making installation easier.
- Movable duct connector flanges for application flexibility.
- Quiet inducer operation, burner, and blower operation.
- Inducer rotates for easy conversion of venting options.
- Fully supported blower assembly for easy access and removal of blower.
- External air filters used for maximum flexibility in meeting customers' IAQ needs.
- Insulated blower compartment for thermal and acoustic performance.
- 1/4 turn knobs provided for easy independent door removal.
- Internal condensate trap design (patent pending) provides condensate management options and is self priming to prevent nuisance problems.
- Protection included from air intake, exhaust vent or condensate blockage.
- Venting applications maybe installed as either 2 pipe sealed combustion or single pipe vent using indoor combustion air.

ITEM # 11

Technical Guide: XAF, XAH, and XAU Series - Add-On Coils for Use with Split-System Cooling and Heat Pumps

600 CFM to 2,000 CFM - 1.5 ton to 5 ton

York International Corporation, 5005 York Drive, Norman, OK 73069

6133680-UTG-A-0821

Supersedes: Nothing

A

2021-08-06

Contents

Description

MaxAlloy™ aluminum indoor coils are specially designed for installation with our residential furnaces or modular air handlers as part of a matched air conditioning or heat pump system.

Our residential indoor coils can be applied with indoor thermostatic expansion valves (TXVs) according to the application. Most indoor coil models are available as flex coils for installation of the specific expansion device in the field. Select SKUs are available with factory-mounted TXVs or electronic expansion valves (EEVs). Refer to the *Technical Guide* for the matched outdoor unit to determine the required indoor expansion device for your specific application.

XAF series full-cased coils are suitable for upflow or downflow applications.

XAH series full-cased coils are designed for dedicated horizontal installation. They are shipped as horizontal left and are easily convertible to horizontal right.

XAU series uncased coils are designed for upflow or downflow applications installed on the leaving air end of gas furnaces. These coils can require field modification of the duct work.

Due to continuous product improvement, specifications are subject to change without notice. Visit us on the web at www.simplygettingthejobdone.com. Additional rating information can be found at www.ahridirectory.org.

This document is only for distribution use - it is not to be used at point of retail sale.

Certification

AMERICAN QUALITY
DESIGNED, ENGINEERED & ASSEMBLED IN THE USA

AHRI CERTIFIED™
www.ahridirectory.org

C SA US

ISO 9000 REGISTRATION
ISO 9001
Certified Quality
Management System

Features

Rigid case construction

The rigid case construction provides structural support and eliminates screw heads protruding from the side of the cabinet that could damage property during installation.

Cabinet

The cabinet is constructed of heavy gauge galvanized steel with a primer and finish coat that provides a high-quality corrosion resistant finish.

MaxAlloy™ coil

These long-life aluminum coils are built to deliver lasting performance, efficiency, and reliability.

Foil-faced insulation

The cabinet is insulated with a single piece of cleanable foil-faced insulation. The cabinet is designed so that all edges of the insulation are contained.

Electronic expansion valve (EEV)

An EEV is factory installed on select models and sized to match with specific high-efficiency variable capacity outdoor units.

Compact cabinet

With the coil and access doors removed, the cabinet has a 20.5-in. casing depth in all models, allowing ease of access in attics and applications where space is constrained.

Thermoset drain pan

The drain pan is corrosion and UV resistant with a positive slope for proper drainage. The low water retention design maximizes indoor air quality and consumer comfort.

Low leakage cabinet design

Fully gasketed doors minimize air leakage to no more than 2% when measured at 1.0 in. W.C. external static pressure, minimizing conditioned air leakage and infiltration.

Duct flange

An integral duct flange is part of the coil casing for easy installation.

Thermostatic expansion valve (TXV)

Select factory installed and field installed models are available. They use Chatleff fittings and no brazing is required.

Accessories

Refer to the *Price Manual* for specific model numbers.

Thermostatic expansion valve (TXV) kits

TXV kits are available for flex coil applications with R-410A refrigerant. All TXV kits are non-braze, bolt-on connections including the valve assembly and equalizer tube. Do not use an orifice or any other metering device in conjunction with the TXV.

Coil casing without coil

Cases without coils are available in four widths that can be installed with the furnace or modular air handler during initial installation. This option is available to allow the installer the flexibility to add the coil at a later date without duct modifications.

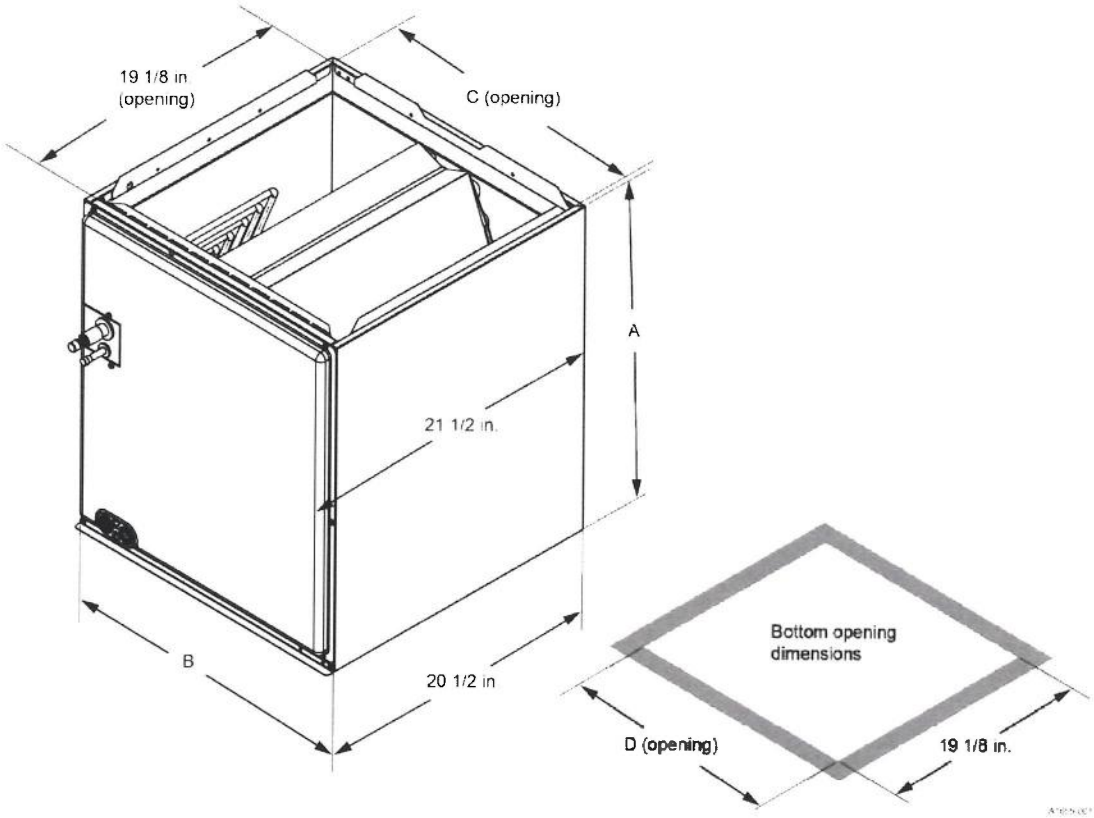
Nomenclature

Table 1: Nomenclature

Product type	**X**	**X** = Coil (indoor)	
Coil type	**A**	**A** = A coil	
		S = Slab coil	
Configuration	**F**	**F** = Full cased, upflow or downflow	
		H = Full cased, horizontal	
		U = Uncased, upflow or downflow	
		D = Horizontal duct	
Cabinet width	**A**	**A** = 14.5 in.	
		B = 17.5 in.	
		C = 21.0 in.	
		D = 24.5 in.	
Nominal capacity	**24**	**18** = 1.5 ton	**42** = 3.5 ton
		24 = 2 ton	**48** = 4 ton
		30 = 2.5 ton	**60** = 5 ton
		36 = 3 ton	
Slab size	**B**	**A** = 2R-14-18	**F** = 3R-24-14
		B = 2R-16-18	**G** = 3R-28-12
		C = 2R-20-18	**H** = 3R-32-12
		D = 3R-20-14	**J** = 4R-28-12
		E = 3R-22-14	
Metering device	**XX**	**BA-BW** = TXV part number	
		E1-E9 = EEV part number	
		XX = No valve (flex coil)	
Accessories	**N**	**S** = A2L sensor	
		N = None (no sensor)	
Generation (major revision)	**1**	**1** = First generation	
		2 = Second generation	
Style letter (minor revision) not used for ordering	**A**	**A** = Style A	
		B = Style B	

Dimensions: XAF coils

Figure 1: Dimensions - XAF upflow or downflow full cased coil



HB Compact Series

ITEM # 11

WATER SOURCE HEAT PUMPS

.5 to 5 Tons
Energy Efficient Heating & Cooling for Commercial Applications

The HB Compact Series raises the bar for water-source heat pump application flexibility. Not only does the HB Compact Series exceed ASHRAE 90.1 efficiencies, but with the new ECM fan motor option, it also delivers higher efficiencies up to 15.9 EER (Tower-Boiler) and 18 EER (Geothermal).

FEATURES

- EarthPure® (HFC-410A) refrigerant
- Exceeds ASHRAE 90.1 efficiencies
- Galvanized steel construction front access panel
- Corrosion resistant polymer drain pan
- Sound absorbing glass fiber insulation
- Unique double isolation compressor mounting for quiet operation
- Insulated divider and separate compressor/air handler compartments
- Copeland scroll compressors (size 024 and above)
- TXV metering device
- Microprocessor controls standard
- Field convertible discharge air arrangement for horizontal units

OPTIONS

- DXM2 Advanced Communicating controls
- Constant Volume Intelligent ECM Fan motors
- MPC building controls
- Water Side Economizer

UNIT SIZE

Horizontal Model		W	D	H
006 - 012	in.	19.1	34.1	11.1
	cm	48.5	86.6	28.2
015 - 018	in.	20.1	43.1	17.0
	cm	51.1	109.5	43.2
024 - 030	in.	20.1	43.1	18.3
	cm	51.1	109.5	46.5
036 - 042	in.	20.1	47.1	21.0
	cm	51.1	119.6	53.3
048 - 060	in.	24.1	54.1	21.0
	cm	61.2	137.4	53.3

Vertical Upflow Model		W	D	H
006 - 012	in.	19.1	19.1	22.0
	cm	48.5	48.5	55.9
015 - 030, 041	in.	21.5	21.5	40.0
	cm	54.6	54.6	101.6
036 - 042	in.	21.5	26.0	45.0
	cm	54.6	66.0	114.3
048 - 060	in.	24.0	32.5	46.0
	cm	61.0	82.6	116.8

Comfort-Aire®

Warranty—5 years on compressor, 1 years on parts
(Some limitations apply; see printed warranty for details.)
www.marsdelivers.com

PHYSICAL DATA

HB Series	006	009	012	015	018	024	030	036	041	042	048	060
Compressor (1 Each)	Rotary					Scroll						
Factory Charge HFC-410A (oz)	19	20	23	35	43	40	48	50	70	70	74	82
ECM Fan Motor & Blower												
Blower Wheel Size (Dia x w)				9x7	9x7	9x7	9x7	9x8		9x8	10x10	12x10
PSC Fan Motor & Blower												
Fan Motor Type/Speeds	PSC/3	PSC/3	PSC-3	PSC/3	PSC/3	PSC/3	PSC/3	PSC/3	PSC/3	PSC/3	PSC/3	PSC/3
Blower Wheel Size (Dia x w)	5x5	5x5	6x5	8x7	8x7	9x7	9x7	9x8	9x8	9x8	10x10	12x10
Water Connection Size												
FPT	1/2"	1/2"	1/2"	1/2"	1/2"	3/4"	3/4"	3/4"	3/4"	3/4"	1"	1"
Coax Volume (gallons)	0.123	0.143	0.167	0.286	0.450	0.286	0.323	0.323	0.890	0.890	0.738	0.939
Vertical												
Air Coil Dimensions (H x W)	10x15	10x15	10x15	20x17.25	20x17.25	20x17.25	20x17.25	24x21.75	20x17.25	24x21.76	24x28.25	24x28.25
Filter Standard - 1" Throwaway	10x18	10x18	10x18	20x20	20x20	20x20	20x20	24x24	20x20	24x24	1-14x24, 1-18x24	1-14x24, 1-18x24
Weight - Operating (lbs.)	103	105	114	153	158	189	197	203	210	218	263	278
Weight - Packaged (lbs.)	113	115	124	158	163	194	202	209	217	224	270	285
Horizontal												
Air Coil Dimensions (H x W)	10x15	10x15	10x15	16x22	16x22	16x22	16x22	20x25		20x25	20x35	20x35
Filter Standard - 1" Throwaway	10x18	10x18	10x18	16x25	16x25	18x25	18x25	20x28 or 2-20x14		20x28 or 2-20x14	1-20x24, 1-20x14	1-20x24, 1-20x14
Weight - Operating (lbs.)	103	105	114	153	158	174	182	203		218	263	278
Weight - Packaged (lbs.)	113	115	124	158	163	179	187	209		224	270	285

Notes:
All units have TXV expansion device, and 1/2" & 3/4" electrical knockouts.
FPT = Female Pipe Thread
Condensate Drain Connection is rubber couplin that couples to 3/4" schedule 40/80 PVC.
575 volt fan motors are two speed.

Unit Maximum Water Working Pressure	Max Pressure PSIG [kPa]
Base Unit	500 [3447]
WSE Option	300 [2068]

TESTED TO ASHRAE/AHRI/ISO 13256-1 ENGLISH (I-P) UNITS

Model	Fan Motor	Water Loop Heat Pump				Ground Water Heat Pump				Ground Loop Heat Pump			
		Cooling 86°F		Heating 68°F		Cooling 59°F		Heating 50°F		Cooling 77°F		Heating 32°F	
		Capacity Btuh	EER Btuh/W	Capacity Btuh	COP	Capacity Btuh	EER Btuh/W	Capacity Btuh	COP	Capacity Btuh	EER Btuh/W	Capacity Btuh	COP
HB-006	PSC	5,800	13.2	7,500	4.7	7,000	21.1	6,300	4.0	6,200	15.4	4,900	3.1
HB-009	PSC	8,600	13.4	11,600	4.3	10,000	21.1	9,700	3.9	9,100	15.7	7,800	3.4
HB-012	PSC	11,100	12.5	14,700	4.3	13,500	19.2	12,100	3.7	12,000	14.3	10,000	3.2
HB-015	PSC	14,300	14.5	17,100	5.0	16,500	24.0	14,100	4.3	14,800	17.0	11,000	3.5
	ECM	14,300	15.5	17,100	5.3	16,500	25.0	14,100	4.5	14,800	18.0	11,000	3.6
HB-018	PSC	18,700	14.0	21,800	5.0	21,500	22.0	17,800	4.2	19,500	16.1	14,100	3.4
	ECM	18,700	15.0	21,800	5.2	21,500	23.6	17,800	4.5	19,500	17.1	14,100	3.7
HB-024	PSC	23,600	13.0	27,500	4.6	27,000	20.5	23,500	4.1	24,500	15.0	18,600	3.3
	ECM	23,600	13.5	27,500	4.8	27,000	21.5	23,500	4.3	24,500	16.0	18,600	3.5
HB-030	PSC	28,600	13.0	37,000	4.7	32,000	19.6	30,500	4.1	29,500	14.7	24,000	3.4
	ECM	28,600	13.6	37,000	4.9	32,000	21.6	30,500	4.3	29,500	16.0	24,000	3.6
HB-036	PSC	34,500	13.2	45,200	4.4	38,700	20.0	37,000	3.9	35,300	14.5	28,700	3.3
	ECM	34,500	14.0	45,200	4.5	38,700	21.0	37,000	4.0	35,300	15.5	28,700	3.4
HBV-041	PSC	36,500	13.2	45,700	4.3	41,400	19.7	38,000	3.7	38,000	14.8	30,000	3.2
HB-042	PSC	41,000	13.2	52,700	4.3	46,400	19.6	42,400	3.8	42,500	14.5	33,900	3.2
	ECM	41,000	14.9	52,700	4.5	46,400	21.0	42,400	4.0	42,500	16.0	33,900	3.4
HB-048	PSC	48,000	13.3	53,600	4.7	54,200	20.5	45,300	4.1	50,400	14.7	36,500	3.4
	ECM	48,000	14.0	53,600	4.8	54,200	21.0	45,300	4.3	50,400	16.2	36,500	3.6
HB-060	PSC	59,500	13.0	72,000	4.3	66,500	18.7	61,000	3.9	61,500	14.5	49,200	3.3
	ECM	59,500	14.6	72,000	4.4	66,500	20.5	61,000	4.0	61,500	16.5	49,200	3.4

Cooling capacities based upon 80.6°F DB, 66.2°F WB entering air temperature
Heating capacities based upon 68°F DB, 59°F WB entering air temperature
All ratings based upon operation at lower voltage of dual voltage rated models

Due to ongoing product improvements, specifications and dimensions are subject to change and correction without notice or incurring obligations. Determining the application and suitability for use of any product is the responsibility of the installer. Additionally, the installer is responsible for verifying dimensional data on the actual product before beginning any installation preparations. All products meet applicable regulations in effect on date of manufacture; however, certifications aren't necessarily granted for life of the product. It is the responsibility of the applicant to determine whether a specific model qualifies for third party incentive/rebate programs (Federal, state, utilities, etc.).

1900 Wellworth Ave., Jackson MI 49203 • 517.787.2100 • www.comfort-aire.com

ITEM # 11

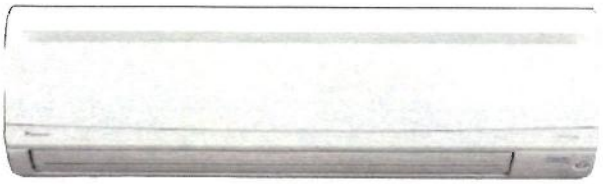
Job Name:	
Tag#	

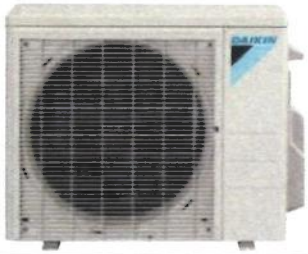
DAIKIN

Submittal Data Sheet

FTXS12LVJU / RXS12LVJU

1-Ton Wall Mounted Heat Pump System





* 12 YEAR PARTS LIMITED WARRANTY

Complete warranty details available from your local dealer or at www.daikincomfort.com. To receive the 12-Year Parts Limited Warranty, online registration must be completed within 60 days of installation. Online registration is not required in California or Quebec. *If product is installed in a commercial application, limited warranty period is 5 years.*

Efficiency

Cooling		Heating	
SEER	23	HSPF	12.5
EER	12.8	COP	4.35

Performance

Cooling (Btu/hr)	
Rated (Min/Max)	12,000 (4,800 / 12,000)
Sensible @ AHRI	9,250
Moisture Removal gal/h	.5
Operating Range	50°F – 115°F

Rated Cooling Conditions: Indoor: 80°F DB/67°F WB; Outdoor: 95°F DB/75°F WB

Heating (Btu/hr)	
1:@ 47° Rated (Min/Max)	14,400 (4,400 / 14,400)
2: @ 17° Rated	9,200
3: @ 5° Max	6,430
Operating Range	5°F – 65°F

1: Rated Heating Conditions: Indoor: 70°F DB/60°F WB; Outdoor: 47°F DB/43°F WB

2: Rated Heating Conditions: Indoor: 70°F DB/60°F WB; Outdoor: 17°F DB/15°F WB

3: Rated Heating Conditions: Indoor: 70°F DB/60°F WB; Outdoor: 5°F DB/5°F WB

Indoor Specifications

	Cooling		Heating	
Airflow Rate (cfm)	H	M	H	M
	403	307	438	335
	L	SL	L	SL
	205	155	240	212
Sound (dBA) H / M / L / SL	45 / 37 / 29 / 23		45 / 39 / 29 / 26	
Dimensions (H × W × D) (in)	11-5/8 × 31-1/2 × 8-7/16			
Weight (Lbs)	22			

Outdoor Specifications

Compressor	Hermetically Sealed Swing Type			
Refrigerant	R-410A			
Refrigerant Oil	PVE (FVC50K)			
Airflow Rate (cfm)	Cooling		Heating	
	H	1,183	H	992
	L	989	L	840
Sound Power Level (dBA)	63			
Dimensions (H × W × D) (in)	21-5/8 × 30-1/8 × 11-1/4			
Weight (Lbs)	75			

Electrical

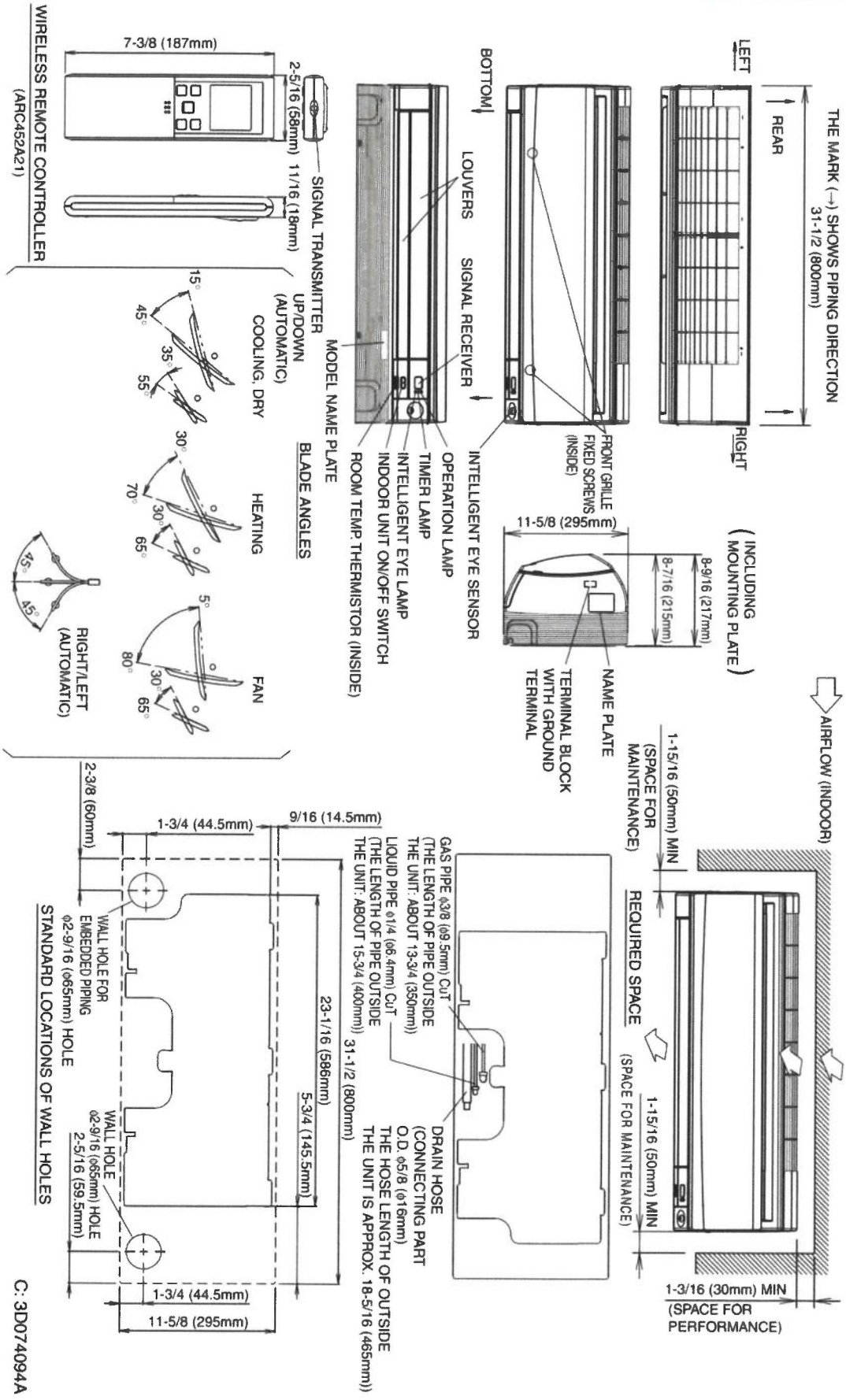
	208/60/1	230/60/1
System MCA	8.75	8.75
System MFA	15	15
Compressor RLA	4.4	3.9
Outdoor fan motor FLA	.22	.22
Outdoor fan motor W	23	23
Indoor fan motor FLA	.15	.15
Indoor fan motor W	23	23

MFA: Max. fuse amps **MCA**: Min. circuit amps (A) **FLA**: Full load amps (A)
RLA: Rated load amps (A) **W**: Fan motor rated output (W)

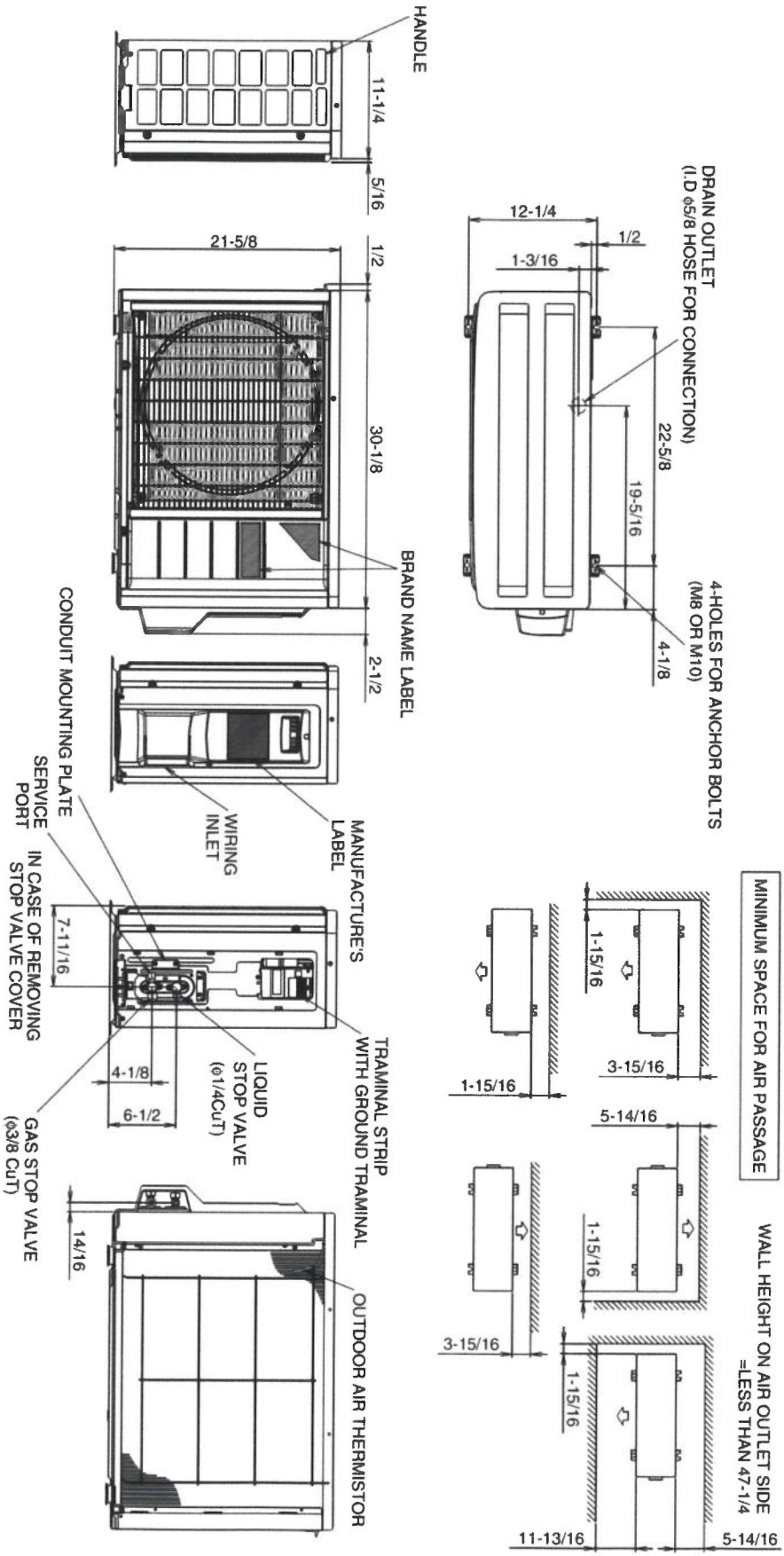
Piping

Liquid (in)	1/4
Gas (in)	3/8
Drain (in)	5/8
Max. Interunit Piping Length (ft)	65.6
Max. Interunit Height Difference (ft)	49.2
Chargeless (ft)	32.8
Additional Charge of Refrigerant (oz/ft)	.21

FTXS12LVJU Dimensional Data



RXS12LVJU Dimensional Data



Optional Accessories

Indoor Unit		
Included	**Part Number**	**Description**
	BRP072A43	Wireless Interface Adapter
	BRC944B2-A08	Wired Remote Controller
	BRCW901A08	Wired Remote Controller Cord - 3m
	DACA-BRCW901P10	Remote Controller Cable, Plenum Rated, 10 ft
	DACA-BRCW901P25	Remote Controller Cable, Plenum Rated, 25 ft
	DACA-TS1-1	Daikin ENVi Intelligent Thermostat Kit
	DACA-CP1-1	Inline Condensate Pump (Fits inside all Daikin wall & floor mount units)
	DACA-CP4-1	External Condensate Pump
	KRP928BB2S	Interface Adaptor for DIII-NET

Description		
Included	**Part Number**	**Description**
	DACA-WB-3	Powder-Coated Wall-Mounted Bracket
	KEH041A41	Drain Pan Heater RXS09_12LV
	KKP937A4	Drain Plug for OD Unit
	KPW937C4	Low Ambient Wind Baffle / Air Adjustment Grille (09/12 MBH)

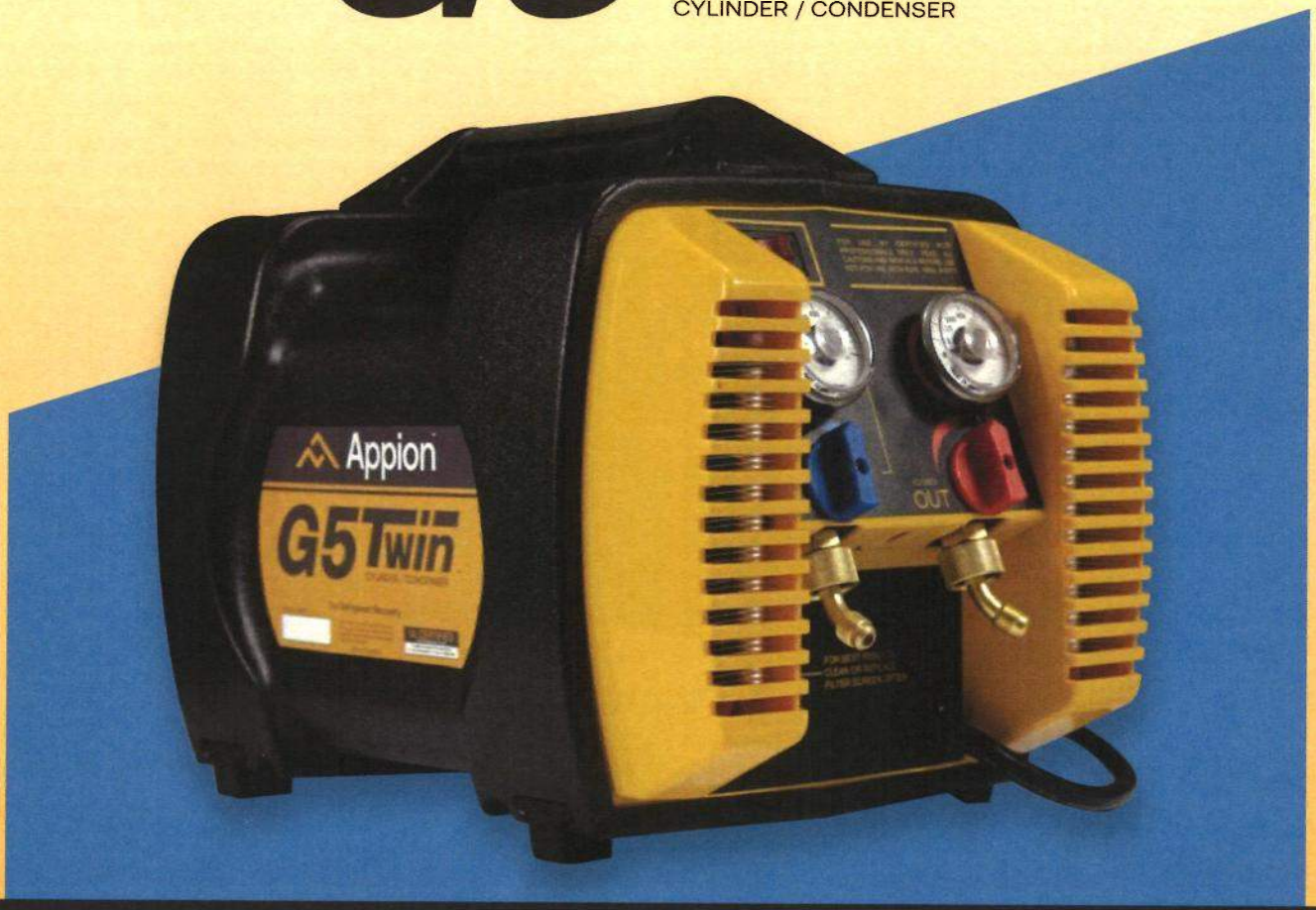
Appion

G5Twin™

CYLINDER / CONDENSER

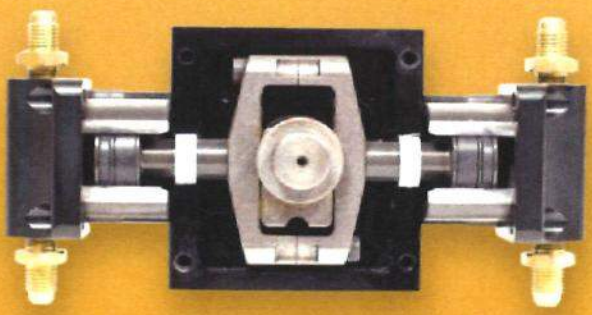
ITEM # 12

Recovery



Automatic **Liquid** and **Vapor** Recovery

4x Faster



Up to 4x Faster **Certified Recovery Rates** compared to other units in its class

Refrigerant-Isolated Crankcase for Maximum Reliability

Part# **G5Twin**

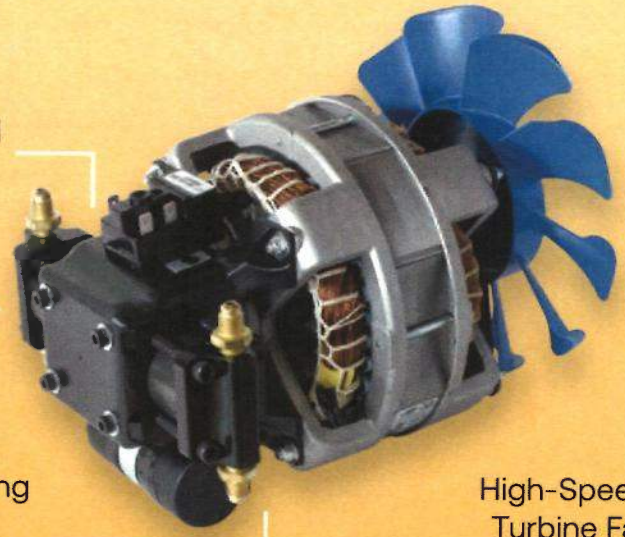
Appion

High-Speed **Industrial** Recovery

Appion

The G5Twin is designed to reliably pump liquid without any need for throttling, cutting down on overall recovery time.

The G5Twin is built with a high-efficiency motor and compressor along with massive airflow. This design allows for maximum pumping performance and cooling efficiency for the fastest refrigerant recovery.



- Patented Opposing **Twin Cylinders and Twin Condensers** for ultra-fast recovery
- **Permanently-lubricated, bearing-lined crankcase** is isolated from refrigerant, eliminating bearing contamination
- Pumps **Liquid and Vapor** with no throttling
- 7-inch, 10-blade turbine fan blasts over **700 cfm of cooling air** over the twin condensers and twin cylinder heads

G5Twin Recovery Rates (per min)

Refrigerant	Liquid	Vapor
R134a	10.14 lb* 4.60 kg*	0.46 lb** 0.21 kg**
R-22	10.36 lb 4.70 kg	0.62 lb 0.28 kg
R-407C	11.93 lb 5.41 kg	0.5 lb 0.25 kg
R410A	17.20 lb 7.80 kg	0.55 lb 0.25 kg

*Using high-speed direct liquid mode; 8.16 lb / 3.7 kg with standard recovery
** With external cooling accessory; 0.44 lb / 0.20 kg with standard recovery

G5Twin	Product Specifications
Dims	11.38 in x 10.30 in x 9.40 in 289 mm x 262 mm x 239 mm
Weight	24 lbs 11 kg
Power	115 VAC, 60 Hz, 10 Amps Int'l: 230 VAC, 50 Hz, 5 Amps

Learn More At
AppionTools.com/G5Twin

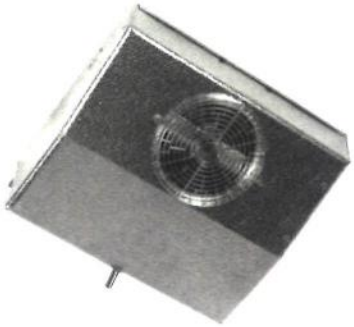
ITEM # 12

TABLE OF CONTENTS

In order to ensure our products function reliably even in corrosive environments, Bohn offers coated coil options on many of our Reach-In products. These coatings provide superior protection in most common refrigeration environments. If you have a question about a specific application, please contact your Bohn representative.

MODEL TA

Thin Profile Air Defrost Reach-In Unit Cooler



Features

- Textured aluminum cabinet
- Molded polycarbonate guards and fans
- Drain fitting mounted at 45-degree angle so drain can be run through back or bottom of refrigerator
- Expansion valve can be mounted inside the cabinet
- Stainless steel screws
- Motors are thermally protected and permanently lubricated
- Convenient, moistureproof motor plug
- Compact design! Does a big job in a small space
- Optional coated coil available (Model TAK) for enhanced protection in corrosive environments
- Internal junction box for electrical connection
- All models are UL listed for the US and Canada
- UL classified to NSF standards
- Sweat inlet connection standard to reduce leaks (flare connection available as a ship loose option)

Application

Model TA is a thin profile unit which mounts in the top of a refrigerator and makes the entire top shelf area usable. The attractive low silhouette makes the unit particularly desirable for display type refrigerators. It can also be used in back bars, under counter cabinets, or wherever space is at a premium.

For 35° to 45°F fixtures at 10° to 15° TD applications with 16 hours maximum compressor run time per day.

Nomenclature

TA	K	17	B	G
Model	**Coil Option**	**Model Size**	**Electrical Code**	**Vintage**
Thin Profile Air Defrost	Blank = Standard K = Coated	10-55	A = 115/1/60 B = 208-230/ 1/60	

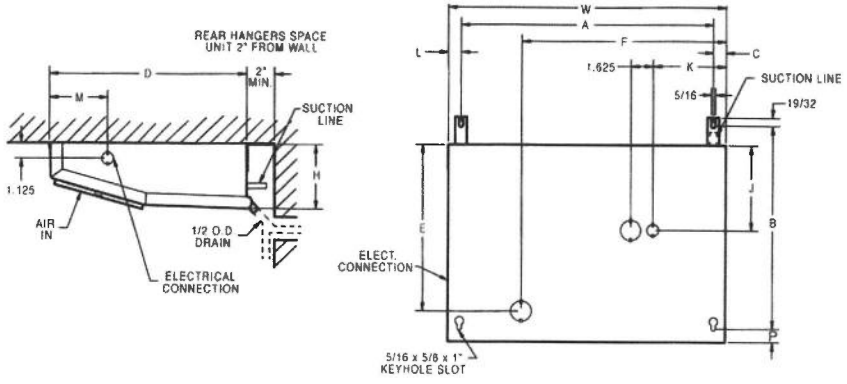
Performance & Electrical Data

Model	BTUH 10°F TD	Motor Data				Connections (in.)			Approx. Ship Wt. (lbs.)
		CFM	Qty.	115/1/60 Total FLA	208-230/1/60 Total FLA	Coil Inlet OD	Suction ID	Drain OD	
TA(K)10	1,000	120	1	0.8	0.4	3/8	3/8	1/2	14
TA(K)13	1,300	170	2	1.6	0.8	3/8	3/8	1/2	17
TA(K)17	1,700	210	2	1.6	0.8	3/8	3/8	1/2	21
TA(K)23	2,300	330	3	2.4	1.2	3/8	3/8	1/2	28
TA(K)30	3,000	360	3	2.4	1.2	3/8	1/2	1/2	33
TA(K)43*	4,300	540	4	3.2	1.6	1/2	5/8	1/2	44
TA(K)55*	5,500	650	5	4.0	2.0	1/2	5/8	1/2	53

**Models 43 and 55 require an external equalized expansion valve*

Physical & Dimensional Data

Model	Dimensions (in.)											
	A	B	C	D	E	F	H	J	K	L	M	W
TA(K)10	14-5/8	14	15/16	13-1/2	10-1/2	11-3/8	4-1/2	8-7/8	2-1/2	15/16	4-3/8	16-1/2
TA(K)13	18-5/8	14	15/16	13-1/2	10-1/8	10-1/4	4-1/2	8-3/8	9-1/2	15/16	4-3/8	20-1/2
TA(K)17	22-1/8	15	15/16	14-1/2	11-1/8	12	4-1/2	9-3/8	11-1/4	15/16	4-3/8	24
TA(K)23	29-3/4	15	15/16	14-1/2	13	20-7/8	4-1/2	10-3/4	10-1/4	15/16	4-3/8	31-5/8
TA(K)30	38-1/8	15	15/16	14-1/2	13	29-3/4	4-1/2	10-3/4	9-3/4	15/16	4-3/8	40
TA(K)43	51-1/2	15	15/16	14-1/2	13	48-3/4	4-1/2	10-3/4	13-1/4	15/16	4-3/8	53-3/8
TA(K)55	51-1/2	15	15/16	14-1/2	13	49	6-3/4	10-3/4	11	15/16	4-3/8	53-3/8



Model TL

Thin Profile Electric Defrost Reach-In Unit Cooler

Features

- Electric defrost ensures positive heat source
- Built-in fan delay allows coil to be chilled before returning to the normal cooling cycle
- Defrost terminates on coil temperature eliminating excessive defrost period
- Textured aluminum cabinet
- Molded polycarbonate guard
- Knockouts provided on sides for electrical connections - opening in rear for coil connections
- Expansion valve can be mounted inside the cabinet
- Stainless steel screws
- Motors are thermally protected and permanently lubricated
- Internal junction box for electrical connection
- Plate type aluminum fins with full collars on expanded copper tubes
- Coils are dehydrated and sealed
- Easy to install and maintain
- All models UL listed for the US and Canada
- UL classified to NSF standards
- Sweat inlet connection to reduce leaks (flare connection available as a ship loose option)

Application

Model TL low temperature unit cooler has a defrost system. standard. Mounted in the top of a refrigerator, its extremely compact cabinet makes it possible to utilize the entire top shelf area for storage. Having a normal operating range of 15°F to -20°F, this unit is ideally suited for such applications as commercial freezers, ice cream boxes and bakery freezers.

Nomenclature

TL	12	B	G
Model	**Size**	**Electrical Code**	**Vintage**
Thin Profile Electric Defrost	09-53	A = 115/1/60 B = 208-230/1/6	

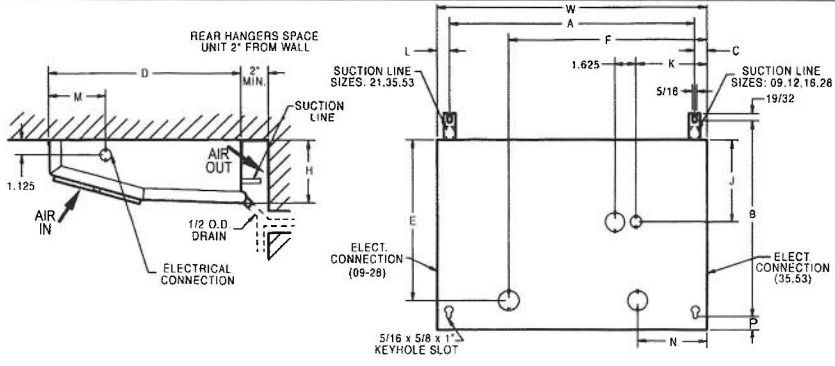
Performance & Electrical Data

Model	BTUH 10°F TD		Motor Data						Heater Data			Connections (in.)			Approx. Ship Wt. (lbs.)
	20°F SST	-10°F SST	CFM	Qty.	115/1/60 Total FLA		208-230/1/60 Total FLA		Watts	115/1/60 Amps	208-230/1/60 Amps	Coil Inlet OD	Suction ID	Drain OD	
					SP	EC	SP	EC							
TL09	1,050	900	110	1	0.8	-	0.4	-	475	4.1	2.1	3/8	3/8	1/2	14
TL12	1,380	1,200	210	2	1.6	-	0.8	-	600	5.2	2.6	3/8	1/2	1/2	19
TL16	1,780	1,600	210	2	1.6	-	0.8	-	700	6.1	3.0	3/8	1/2	1/2	23
TL21^	2,400	2,100	240	1	1.0	0.4	0.5	0.2	1,100	9.6	4.8	3/8	1/2	1/2	24
TL28	3,200	2,800	335	3	-	-	1.2	-	1,430	-	5.7	3/8	1/2	1/2	27
TL35^*	4,000	3,500	420	2	-	-	1.0	0.4	1,600	-	7.0	1/2	5/8	1/2	38
TL53^*	6,100	5,300	595	3	-	-	1.5	0.6	1,950	-	8.5	1/2	7/8	1/2	53

^ Model available with EC motors
** Models 35 and 53 require an external equalized expansion valve*

Physical & Dimensional Data

Model	Dimensions (in.)													
	A	B	C	D	E	F	H	J	K	L	M	N	P	W
TL09	14-5/8	14	15/16	13-1/2	10-1/2	11-3/8	4-1/2	8-7/8	2-1/2	15/16	4-3/8	-	1	16-1/2
TL12	18-5/8	14	15/16	13-1/2	10-1/8	10-1/4	4-1/2	8-3/8	9-1/2	15/16	4-3/8	-	1	20-1/2
TL16	22-1/8	15	15/16	14-1/2	11-1/8	12	4-1/2	9-3/8	11-1/4	15/16	4-3/8	-	1	24
TL21	22-1/8	16-1/2	15/16	16-1/2	14-1/2	18-7/8	6-3/4	11-7/8	17-1/4	15/16	4-3/8	-	1-1/2	24
TL28	29-3/4	15	15/16	14-1/2	13	20-3/4	6-3/4	9-3/4	9-7/8	15/16	4-3/8	-	1	31-5/8
TL35	35-3/4	16-1/2	15/16	16-1/2	14-1/2	33-1/4	6-3/4	11-5/8	18-3/8	15/16	6	5-1/8	1-1/2	38-3/8
TL53	46-1/2	16-1/2	1-1/8	16-1/2	14-1/2	44	6-3/4	11-5/8	30-3/8	1-1/2	6	5-1/8	1-1/2	49-1/8



MODEL C
High Profile Reach-In Unit Cooler

Features

- Textured aluminum cabinet
- Molded polycarbonate guard
- Drain fitting at 45-degree angle so drain can be run through bottom or back of refrigerator
- Aluminum hangers automatically space the unit to the correct distance from the back wall
- Stainless steel screws prevent rust streaks
- Room for expansion valve inside the unit
- Knockouts in sides and top plus openings in rear provide maximum flexibility for electrical connection
- Expansion valve can be mounted inside the cabinet
- Full collar aluminum fins on expanded copper tubes
- Internal junction box with pigtail leads for electrical connection
- Motors are thermally protected and permanently lubricated
- All models UL listed for US and Canada
- UL classified to NSF standards
- Optional coated coil available (Model CK) for enhanced protection in corrosive environments
- Sweat inlet connection standard to reduce leaks (flare connection available as a ship loose option)

Application

Model C is the ideal unit for refrigerated reach-ins. It mounts to the top of the refrigerator and discharges cold air against the back wall. With this air flow pattern, the air is not blasted on the product but is diffused along the back wall and then gently drawn across the product as it returns to the unit. Thus uniform temperatures are maintained throughout the refrigerator. In addition, door sweating and refrigeration loss due to door opening is greatly reduced because the air is not discharged against the doors.

Nomenclature

C	K	43	B	G
Model	**Coil Option**	**Model Size**	**Electrical Code**	**Vintage**
High Profile Unit Cooler	Blank = Standard K = Coated	13-43	A = 115/1/60 B = 208-230/1/60	

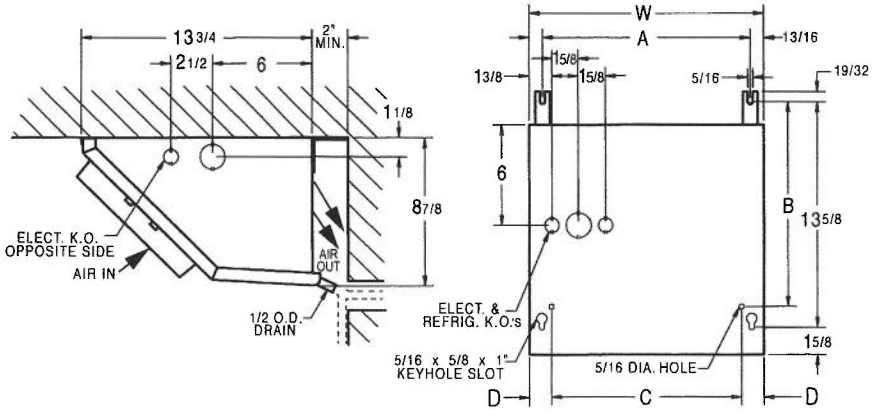
Performance & Electrical Data

Model	BTUH 10°F TD	Motor Data						Connections (in.)			Approx. Ship Wt. (lbs.)
		CFM	Qty.	115/1/60 Total FLA		208-230/1/60 Total FLA		Coil Inlet OD	Suction ID	Drain OD	
				SP	EC	SP	EC				
C(K)13^	1,300	235	1	1.0	0.4	0.5	0.2	3/8	3/8	1/2	16
C(K)17^	1,700	250	1	1.0	0.4	0.5	0.2	3/8	1/2	1/2	17
C(K)23^	2,300	265	1	1.0	0.4	0.5	0.2	3/8	1/2	1/2	22
C(K)30^	3,000	480	2	2.0	0.8	1.0	0.4	3/8	1/2	1/2	27
C(K)43^*	4,300	520	2	2.0	0.8	1.0	0.4	1/2	1/2	1/2	40

^ Model available with EC motors
** Model 43 requires an external equalized expansion valve*

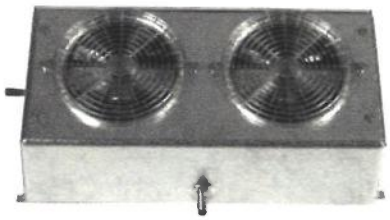
Physical & Dimensional Data

Model	Dimensions (in.)				
	A	B	C	D	W
C(K)13	12-5/8	12-3/8	11-7/16	1-3/8	14-1/4
C(K)17	15-5/8	12-3/8	14-7/16	1-3/8	17-1/4
C(K)23	21-1/8	12-3/8	21-1/16	7/8	22-3/4
C(K)30	26-1/8	12-3/8	25-13/16	1	27-3/4
C(K)43	36-5/16	-	-	-	38



MODEL VA

Vee-Aire Reach-In Unit Cooler



Features

- Textured aluminum cabinet
- Molded polycarbonate fan guard
- Improved drain pan overlaps coil surface to catch all condensate
- Stainless steel screws prevent rust streaks
- Plate-type aluminum fins with full collars on expanded copper tubes
- Expansion valve can be mounted inside the cabinet
- Internal junction box for electrical connection
- Pigtail leads in junction box
- Motors are thermally protected and permanently lubricated
- Top quality throughout in a compact size
- All models UL listed for US and Canada
- UL classified to NSF standards
- Optional coated coil available (Model VAK) for enhanced protection in corrosive environments
- Sweat inlet connection standard to reduce leaks (flare connection available as a ship loose option)

Application

Model VA is a deluxe unit designed for use in small reach-ins, back bar and under counter refrigerators, and many other applications where a small, compact unit is required. The thermal expansion valve mounts inside the unit. The unit can be mounted from the ceiling or off the back wall or end walls.

Nomenclature

VA	K	08	A	G
Model	**Coil Option**	**Model Size**	**Electrical Code**	**Vintage**
V Profile Unit Cooler	Blank = Standard K = Coated	06-17	A = 115/1/60 B = 208-230/1/60	

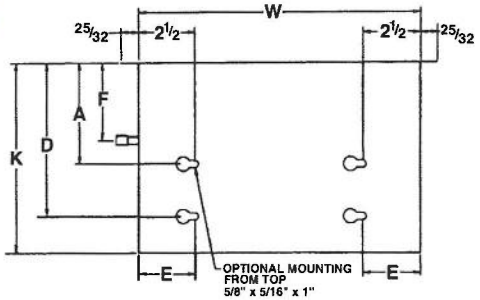
Performance & Electrical Data

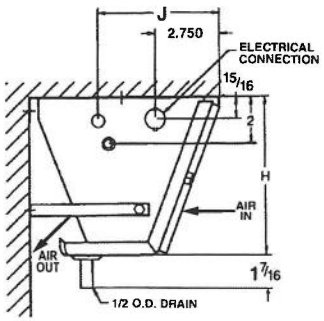
Model	BTUH 10°F TD	Motor Data						Connections (in.)			Approx. Ship Wt. (lbs.)
		CFM	Qty.	115/1/60 Total FLA		208-230/1/60 Total FLA		Coil Inlet OD	Suction ID	Drain OD	
				SP	EC	SP	EC				
VA(K)06	600	135	1	0.8	-	0.4	-	3/8	3/8	1/2	9
VA(K)08	800	130	1	0.8	-	0.4	-	3/8	3/8	1/2	9
VA(K)12	1,200	265	2	1.6	-	0.8	-	3/8	3/8	1/2	14
VA(K)17^	1,700	245	1	1.0	0.4	0.5	0.2	3/8	3/8	1/2	11

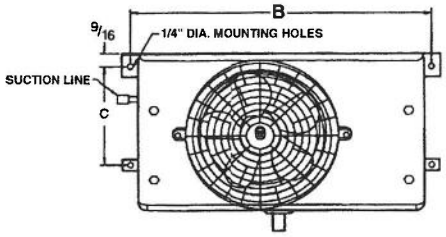
^ Model available with EC motors

Physical & Dimensional Data

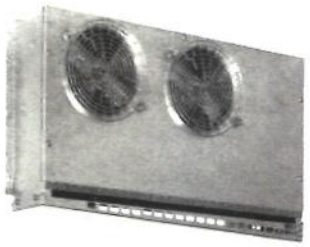
Model	Dimensions (in.)									
	A	B	C	D	E	F	H	J	K	W
VA(K)06	4-5/16	13-1/4	4-5/16	-	-	3-3/8	6-7/8	5-1/4	8-1/8	12-1/2
VA(K)08	4-5/16	13-1/4	4-5/16	-	-	3-3/8	6-7/8	5-1/4	8-1/8	12-1/4
VA(K)12	4-1/2	18-3/4	5-5/16	-	-	3-3/8	8	4-7/8	8-1/8	18
VA(K)17	5-1/4	14-3/4	5-1/4	9	2-1/2	4	9-3/4	6-13/16	10-1/2	14







MODELS BBM/BBL
Back Bar Reach-In Unit Cooler



Features

- Molded polycarbonate fan guards
- Coils have copper tubes with aluminum fins, mechanically-bonded for efficient heat transfer. The coils are dehydrated and sealed
- Textured aluminum cabinet
- Knockouts are conveniently located for refrigerant lines
- Screws are hardened, stainless steel
- Expansion valve can be mounted inside the cabinet and connections are sweat-type
- Motors are thermally protected and permanently lubricated
- Master units include the basic unit plus factory mounted R-404a expansion valve, solenoid, and temperature control. Also right-hand piping extended 8" - 12" outside the housing, sealed and pressurized to 20 - 30 PSI. A 1/4" OD liquid feed to slave is included
- Slave units include the basic unit plus factory mounted expansion valve with left-hand piping extended 8" - 12" outside the housing, sealed and pressurized to 20 - 30 PSI
- Sweat inlet connection to reduce leaks (flare connection available as a ship loose option)

Application

Models BB are compact, wall-mounted units whose low height makes them ideal for undercounter reach-in or drawer-type fixtures. The unit draws air in at the bottom and discharges out the front. An optional air deflector is included and can be mounted over the center of the fan to direct air up and out. The deflector can be field-formed to direct the air where needed, usually onto drop-in trays of condiments in salad bar or sandwich preparation fixtures. An S-type mounting angle is included to position the unit 3/4" off the wall which gives optimum air circulation and performance.

The BBM (medium temperature) model is designed for 35° to 40°F fixture temperature with off-cycle defrost. The unit is designed to operate at 10° to 17° TD and 16 hours per day compressor run time.

The BBL (low temperature) model is designed for 0° to -10°F fixture temperature, and has automatic electric defrost. The unit is designed to operate at 8° to 15°TD with 18 hours per day compressor runtime. The BBL has an incoloy sheath heater embedded in the bottom fin surface for efficient and fast defrosting. A drain pan heater is included to ensure complete condensate drainage. A disc-type sealed defrost termination/fan delay control is mounted and wired. Field connectors are located at the terminal board.

Nomenclature

BB	L	S	10	A	G
Model	Unit Temp.	Unit Type	Size	Electrical Code	Vintage
Back Bar Unit Cooler	L = Low M = Medium	Blank = Standard S = Slave M = Master	10-16	A = 115/1/60 B = 208-230/1/60	

Performance & Electrical Data

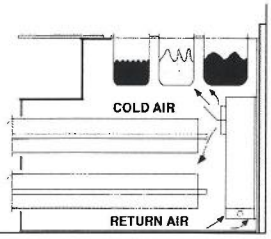
Model	BTUH 10°F TD	Motor Data					Defrost Heaters		
		CFM	Qty.	HP	115/1/60 Total FLA	208-230/1/60 Total FLA	Watts	115/1/60 Amps	208-230/1/60 Amps
BBL10	1,000	90	1	1/150	0.8	0.4	275	2.7	1.4
BBM11	1,100	90	1	1/150	0.8	0.4	-	-	-
BBL15	1,500	180	2	1/150	1.6	0.8	350	3.5	1.7
BBM16	1,600	180	2	1/150	1.6	0.8	-	-	-

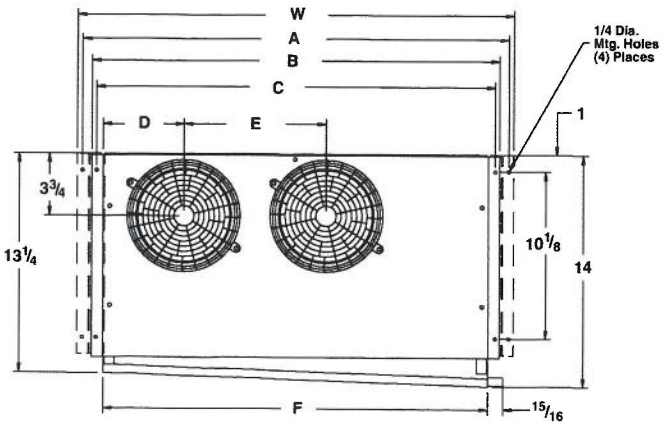
Physical & Dimensional Data

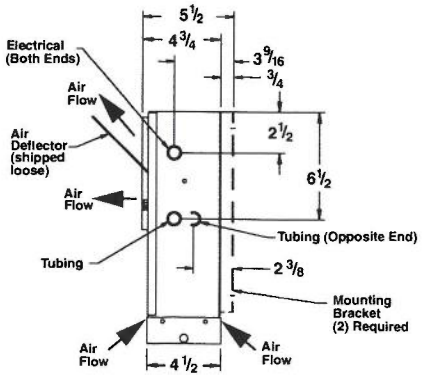
Model	Dimensions (in.)							Approx. Ship Wt. (lbs.)
	A	B	C	D	E	F	W	
BBL10	19-1/8	18	17-1/2	7-1/16	-	16-5/8	19-3/4	17
BBM11	19-1/8	18	17-1/2	7-1/16	-	16-5/8	19-3/4	16
BBL15	25-5/8	24-1/2	24	4-13/16	8-5/8	23-1/8	26-1/4	20
BBM16	25-5/8	24-1/2	24	4-13/16	8-5/8	23-1/8	26-1/4	19

NOTES: *All units have 3/8" OD suction, 1/2" OD sweat inlet and 1/2" OD drain*

Typical Section of Sandwich Station Model BBM



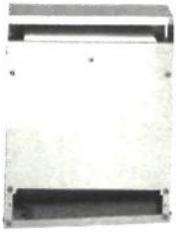




MODEL KMK
Kompact Mullion Reach-In Unit Cooler

Features

- Light grained aluminum cabinets
- Powder coated wire fan guard
- Stainless steel hardware
- Coils have full collar aluminum fins on expanded copper tubes
- Coated coil for enhanced protection in corrosive environments
- Refrigerant connection knockouts provided on both ends of unit
- Expansion valve can be mounted inside the cabinet
- Motors are thermally protected and permanently lubricated
- Internal junction box for electrical connection
- Adjustable air deflector included provides different air patterns. Air can be directed where it's needed
- All models UL listed for the US and Canada
- UL classified to NSF standards
- Sweat inlet connection to reduce leaks (flare connection available as a ship loose option)



Application

Model KMK is ideal for under-counter reach-in refrigerators. The thin line design allows the unit to be mounted behind the mullion with sufficient clearance for tray slides. A down flow fan arrangement is used with air drawn in at the top and discharged at the bottom. This design provides superior air circulation and ensures uniform temperature throughout the cabinet.

This versatile design is also adaptable for mounting on the back wall or ends of a cooler. The method of air circulation ensures minimum box temperature rise when the cabinet doors are open. Ideal for bottle goods and beverage coolers.

Nomenclature

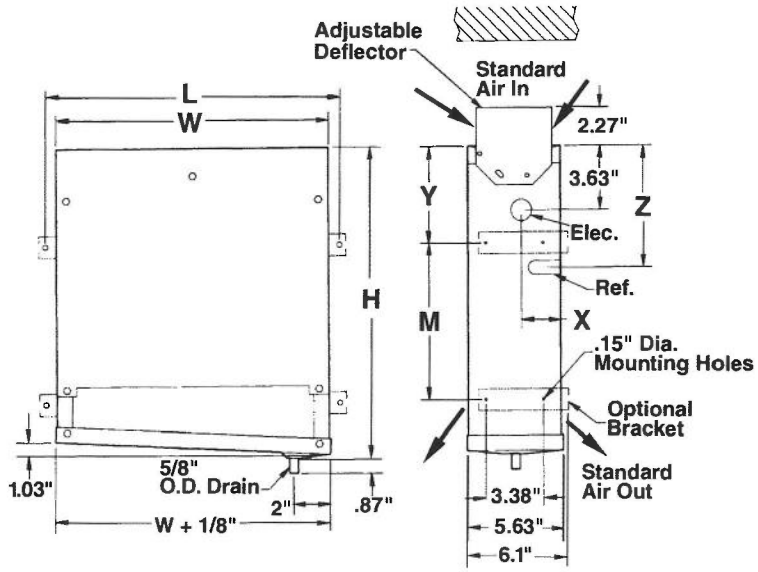
KM	K	13	A	G
Model	Coil	Size	Electrical Code	Vintage
Kompact Mullion	K = Coated	13-23	A = 115/1/60 B = 208-230/1/60	

Performance & Electrical Data

Model	BTUH 10°F TD	Motor Data				Connections (in.)			Approx. Ship Wt. (lbs.)
		CFM	Qty.	115/1/60 Total FLA	208-230/1/60 Total FLA	Coil Inlet OD	Suction ID	Drain OD	
KMK13	1,300	180	2	1.6	0.8	3/8	3/8	5/8	19
KMK17	1,700	170	2	1.6	0.8	3/8	3/8	5/8	20
KMK23	2,300	255	3	2.4	1.2	3/8	1/2	5/8	28

Physical & Dimensional Data

Model	Dimensions (in.)						
	H	L	M	W	X	Y	Z
KMK13	17-3/4	16-7/8	9	15-5/8	2-3/4	5-1/2	6-15/16
KMK17	19-3/4	16-7/8	10	15-5/8	2-3/4	6-1/2	7-15/16
KMK23	19-3/4	23-1/4	10	22	2-5/16	6-1/2	7-15/16

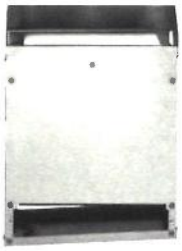


MODEL RAMK

Reverse Air Flow Kompact Mullion Reach-In Unit Cooler

Features

- Textured aluminum cabinet
- Powder coated wire fan guard
- Stainless steel hardware
- Coils have full collar aluminum fins on expanded copper tubes
- Coated coil for enhanced protection in corrosive environments
- Refrigerant connection knockouts provided on both ends of unit
- Expansion valve can be mounted inside the cabinet
- Motors are thermally protected and permanently lubricated
- Internal junction box for electrical connection
- Adjustable air deflector included provides different air patterns. Air can be directed where it's needed
- All models are UL listed for the US and Canada
- UL classified to NSF standards
- Sweat inlet connection standard to reduce leaks (flare connection available as a ship loose option)



Application

Model RAMK is ideal for under-counter reach-in refrigerators, under-counter drawer type refrigerators and salad bars. The unit is suitable for mounting behind a mullion or on a wall. An up flow air pattern is used with air drawn in at the bottom and discharged out the top. This provides optimum temperature for drop in trays on salad bars or prep tables. It also keeps drawer stored product in premium condition.

An adjustable and detachable air deflector/splash protector is included. The deflector can be adjusted to direct the air up and out at a 45-degree angle. This feature provides excellent air distribution over drop in trays or containers. Food in the trays and containers stays colder, lasts longer, and retains the desired appearance. The deflector can be adjusted to distribute air out both sides when used as a mullion unit.

Nomenclature

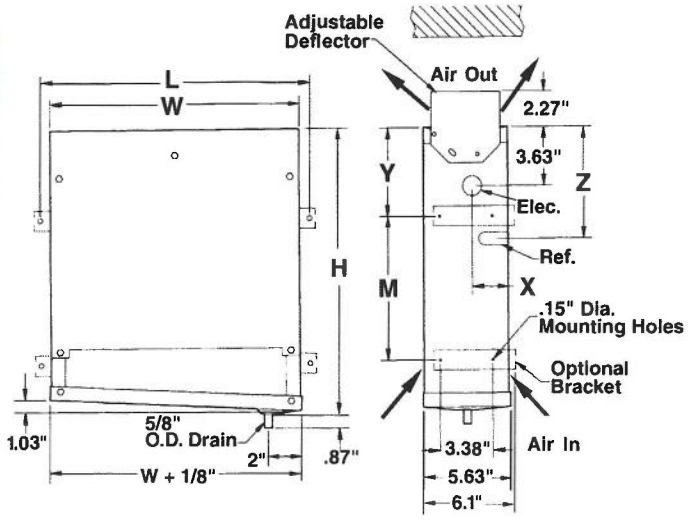
RAM	K	13	A	G
Model	Coil	Size	Electrical Code	Vintage
Reverse Air Flow Kompact Mullion	K = Coated	13-23	A = 115/1/60 B = 208-230/1/60	

Performance & Electrical Data

Model	BTUH 10°F TD	Motor Data				Connections (in.)			Approx. Ship Wt. (lbs.)
		CFM	Qty.	115/1/60 Total FLA	208-230/1/60 Total FLA	Coil Inlet OD	Suction ID	Drain OD	
RAMK13	1,300	180	2	1.6	0.8	3/8	3/8	5/8	19
RAMK17	1,700	170	2	1.6	0.8	3/8	3/8	5/8	20
RAMK23	2,300	255	3	2.4	1.2	3/8	1/2	5/8	28

Physical & Dimensional Data

Model	Dimensions (in.)						
	H	L	M	W	X	Y	Z
RAMK13	17-3/4	16-7/8	9	15-5/8	2-3/4	5-1/2	6-15/16
RAMK17	19-3/4	16-7/8	10	15-5/8	2-3/4	6-1/2	7-15/16
RAMK23	19-3/4	23-1/4	10	22	2-5/16	6-1/2	7-15/16



MODEL BTO

Twin Flow Reach-In Unit Cooler

Features

- Compact two-way design with medium velocity air flow
- Mounts flush to the ceiling and draws air in through the fan and discharges out both sides
- Air pattern reduces air loss when doors are opened and the medium velocity reduces product drying
- Textured aluminum cabinet
- Stainless steel fasteners
- Molded polycarbonate or powder coated wire fan guards
- Drain pan and fan panel is easily removed for installation and servicing
- Optional coated coil available (Model BTOK) for enhanced protection in corrosive environments
- Coils are constructed of copper tubing with aluminum fins
- Expansion valve can be mounted inside the cabinet
- Internal junction box is provided for electrical connection
- Motors are thermally protected and permanently lubricated
- All models are UL listed for the US and Canada
- UL classified to NSF standards
- Sweat inlet connection to reduce leaks (flare connection available as a ship loose option)

Application

Model BTO is ideal for temperatures of 35°F and higher. Box temperatures are kept more constant throughout and fresh products last longer. Seven sizes are available with BTUH from 900 to 5,500 at 10° TD.

Larger BTO sizes are suitable for large reach-in and small step-in or walk-in coolers.

Nomenclature

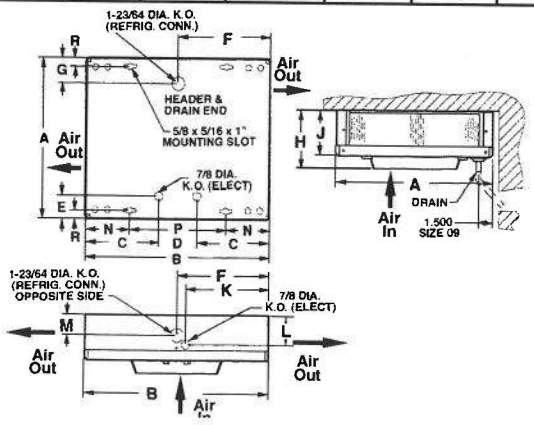
BTO	K	09	A	G
Model	**Coil Option**	**Size**	**Electrical Code**	**Vintage**
Twin Flow Unit Cooler	Blank = Standard K = Coated	09-55	A = 115/1/60 B = 208-230/1/60	

Performance & Electrical Data

Model	BTUH 10°F TD	BTUH 15°F TD	Motor Data						Connections (in.)			Approx. Ship Wt. (lbs.)
			CFM	Qty.	115/1/60 Total FLA		208-230/1/60 Total FLA		Coil Inlet OD	Suction ID	Drain OD	
					SP	EC	SP	EC				
BTO(K)09	900	1,350	130	1	0.8	-	0.4	-	1/2	1/2	1/2	12
BTO(K)13	1,300	1,950	240	2	1.6	-	0.8	-	1/2	1/2	1/2	14
BTO(K)18^	1,800	2,700	255	1	1.0	0.4	0.5	0.2	1/2	1/2	1/2	15
BTO(K)25^*	2,500	3,750	460	2	2.0	0.8	1.0	0.4	1/2	1/2	1/2	23
BTO(K)35^*	3,500	5,250	425	2	2.0	0.8	1.0	0.4	1/2	1/2	1/2	24
BTO(K)45^*	4,500	6,750	550	2	2.0	0.8	1.0	0.4	1/2	1/2	5/8	34
BTO(K)55^*	5,500	8,250	730	1	2.1	0.9	1.1	0.5	1/2	1/2	5/8	34

^ Model available with EC motors ** Models 25, 35, 45 and 55 require an external equalized expansion valve*

Model	Dimensions (in.)														
	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R
BTO(K)09	16-1/8	19-1/8	7-9/16	4	2-5/16	9-9/16	2-3/4	4-7/8	4-1/2	8-5/8	2-1/2	2-5/8	4-9/16	10	7/8
BTO(K)13	16-1/8	19-1/8	7-9/16	4	2-5/16	9-9/16	2-3/4	5-3/4	4-1/2	8-5/8	2-1/2	2-5/8	4-9/16	10	7/8
BTO(K)18	16-1/8	19-1/8	7-9/16	4	2-5/16	9-9/16	2-3/4	5-3/4	4-1/2	8-5/8	2-1/2	2-5/8	4-9/16	10	7/8
BTO(K)25	18-1/8	26-1/8	11-1/16	4	2-5/16	13-1/16	2-3/4	6-3/4	5-1/2	12-1/8	3-1/2	2-5/8	8-1/16	10	7/8
BTO(K)35	18-1/8	26-1/8	11-1/16	4	2-5/16	13-1/16	2-3/4	6-3/4	5-1/2	12-1/8	3-1/2	2-5/8	8-1/16	10	7/8
BTO(K)45	21-1/8	29-1/8	8-3/16	7-3/4	3-7/16	10-5/8	3-1/2	9-1/4	8	13-5/8	5-15/16	4-1/4	7-9/16	14	1-3/4
BTO(K)55	21-1/8	29-1/8	8-3/16	7-3/4	3-7/16	10-5/8	3-1/2	8-1/2	8	13-5/8	5-15/16	4-1/4	7-9/16	14	1-3/4



MODEL U
Dual Aire Standard Coil Reach-In Unit Cooler

Features

- Textured aluminum cabinet
- Full collar aluminum fins on expanded copper tubes
- Detachable drain pan that is easy to clean
- Molded 3-prong motor connector to save installation time and expense
- Motors are thermally protected and permanently lubricated
- Optional coated coil available (Model UK) for enhanced protection in corrosive environments
- All models are UL recognized for the US and Canada
- UL classified to NSF standards
- Sweat inlet connection to reduce leaks (flare connection available as a ship loose option)

Application

Model U is used wherever a small, compact unit is required. It can be mounted on the ceiling or wall. The model U unit draws air through the front and discharges it out both sides to ensure proper distribution of cool air and thus maintain a uniform box temperature.

Nomenclature

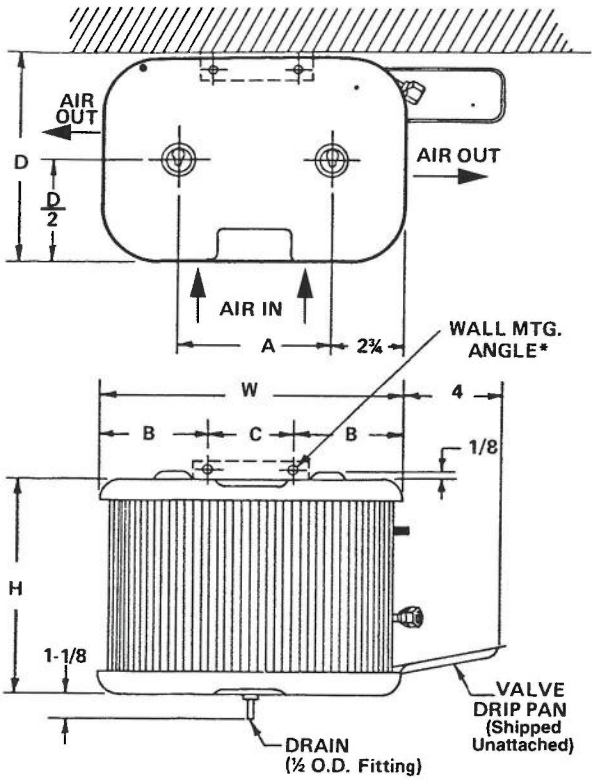
U	K	09	0
Model	**Coil Option**	**Size**	**Electrical Code**
Dual Aire Standard Coil	Blank = Standard K = Coated	09-15	0 = 115/1/60 1 = 208-230/1/60

Performance & Electrical Data

Model	BTUH 10°F TD	BTUH 15°F TD	Motor Data			Connections (in.)			Approx. Ship Wt. (lbs.)
			CFM	115/1/60 Total FLA	208-230/1/60 Total FLA	Coil Inlet FN	Suction ID	Drain OD	
U(K)09	850	1,275	190	0.45	0.55	1/2	3/8	1/2	9
U(K)12	1,150	1,725	250	0.45	0.55	1/2	3/8	1/2	10
U(K)15	1,500	2,250	310	1.10	0.55	1/2	3/8	1/2	14

Physical & Dimensional Data

Model	Dimensions (in.)					
	H	W	D	A	B	C
U(K)09	8-1/2	11-1/2	8-7/8	6	4	3-1/2
U(K)12	8-1/2	17-1/2	8-7/8	12	4	9-1/2
U(K)15	9-1/2	17-1/2	10-7/8	12	4	9-1/2

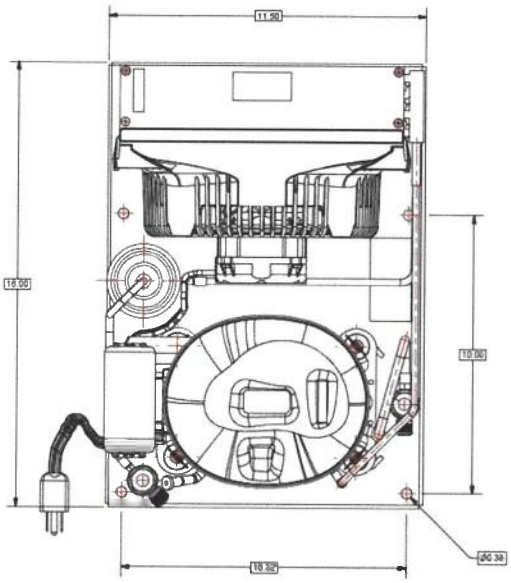


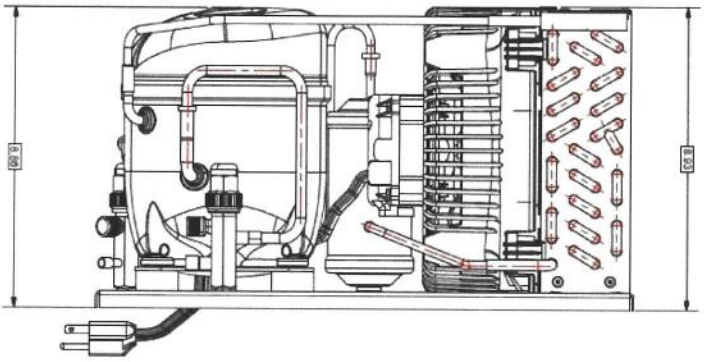
ITEM # 12

October 6, 2022
Revision: D

Indoor Condensing Unit Technical Data Sheet

Model: AE2415Z-AA1AS* **BoM: 32F328-*(9S)** **R-404A / R-448A / R-449A** **1/3 HP**





Model	Dimensions, inches				Line Connection*		Pumpdown	Air	Oil Ch	Gr. Wt.
	L	W	H	CH	Suction	Liquid	90 °F 90%	CFM	Oz.	Lbs.
AE2415Z-AA1ASK	16.0	11.5	8.93	8.86	5/16" S	1/4" S	n/a	190	9.5	38.1
AE2415Z-AA1ASB							1.83 lbs.			38.7
AE2415Z-AA1ASC					3/8" S	1/4" S	1.83 lbs.			39.5
AE2415Z-AA1ASS							n/a			38.9

* F = Flare, S = Solder, RF or RS = Rotolock with Flare or Solder Connections, C = Compression Fitting
Factory charge: 20 PSIG Nitrogen – **MUST BE EVACUATED**

Evaporator		R-404A Performance Ambient Temperatures											
		80°F			90°F			100°F			110°F		
°F	PSIG	BTU/H	Watts	Cond T	BTU/H	Watts	Cond T	BTU/H	Watts	Cond T	BTU/H	Watts	Cond T
-40	4.5	630	270	87	550	260	97	480	260	106	410	250	116
-35	7.0	740	280	89	650	280	98	570	280	107	490	280	117
-30	9.8	880	300	90	770	300	100	680	300	109	590	300	118
-25	12.9	1020	320	92	910	320	101	800	320	111	700	320	120
-20	16.2	1190	340	94	1060	350	103	930	350	112	810	350	121
-15	19.9	1360	370	97	1220	370	105	1080	370	114	940	380	123
-10	23.8	1540	390	99	1380	390	108	1230	400	117	1080	400	125
-5	28.1	1730	410	101	1550	420	110	1380	430	119	1220	430	128
0	32.8	1930	440	104	1730	450	113	1540	460	121	1360	460	130
5	37.9	2120	470	107	1910	480	115	1710	490	124	1500	490	132
10	43.3	2330	490	109	2090	510	118	1870	520	126	1650	530	134

Performance @ 60Hz, Return Gas 40°F, Sub cooling 5°F

October 6, 2022
Revision: D

Evaporator		R-448A / R-449A Performance Ambient Temperatures											
		80°F			90°F			100°F			110°F		
°F	PSIG	BTU/H	Watts	Cond T	BTU/H	Watts	Cond T	BTU/H	Watts	Cond T	BTU/H	Watts	Cond T
-40	0.0	659	242	93	591	239	102	523	237	111	455	234	120
-35	2.1	772	257	93	693	256	102	615	255	111	537	253	120
-30	4.4	894	274	94	805	274	103	716	274	112	627	274	120
-25	7.0	1024	292	95	924	293	103	825	294	112	725	295	121
-20	9.9	1162	311	96	1052	313	105	942	315	113	833	318	122
-15	13.0	1309	331	98	1189	335	106	1068	338	114	948	342	123
-10	16.4	1465	353	100	1334	357	108	1203	362	116	1072	367	124
-5	20.2	1629	375	102	1487	381	110	1346	387	117	1205	393	125
0	24.3	1801	399	104	1649	406	112	1497	414	120	1345	421	127
5	28.7	1982	425	107	1819	433	114	1657	441	122	1495	450	129
10	33.5	2171	451	110	1998	461	117	1825	470	125	1652	480	132

Performance @ 60Hz, Return Gas 40°F, Sub cooling 5°F

Specifications/ Parts:

Unit Model	**AE2415Z-AA1ASK**
Unit Bill of Material	**32F328-39S**
Refrigeration Range	-40° F to 10° F
Design Pressure Low	181
Design Pressure High	450
Nominal Volts-Hz-Ph	115/60/1
Voltage Range	103 to 127
Min. Circuit Ampacity	6.82
Max. Fuse Size (amps)	15
Compressor Model	AE2415Z-AA1A
Comp. Bill of Material	AE1157E-679-J7
Compressor RLA/LRA	4.99/32.0
Overload	T90731-24-ZP
Relay	820-10087
Run Capacitor	N/A
Start Capacitor	85PS165C99
Power Cord	85106-10
Fan Motor	810L009B96
Fan Motor RLA	.58
Fan Blade	51578
Fan Shroud/Guard Combo	116-002P
Condenser	506-G434
Unit Drawing	DGU1896-G103K
Wiring Diagram	DEAE-10

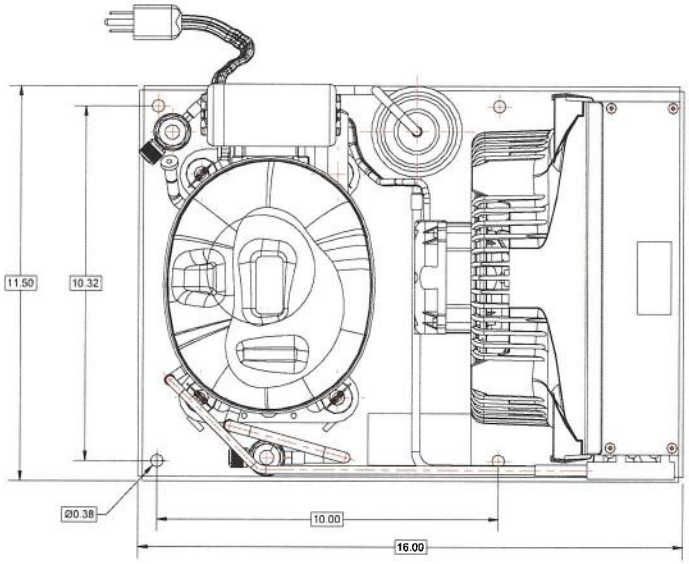
Unit Model	**AE2415Z-AA1ASB**
Unit Bill of Material	**32F328-49S**
Receiver Tank	51085-1
Power Cord	85106-19
Unit Drawing	DGU1896-G103-CV
Unit Model	**AE2415Z-AA1ASC**
Unit Bill of Material	**32F328-59S**
Receiver Tank	51085-1
Power Cord	85106-10
Unit Drawing	DGU1896-G103J-CV
Liquid Valve	56605
Suction Valve	56604
Unit Model	**AE2415Z-AA1ASS**
Unit Bill of Material	**32F328-69S**
Power Cord	85106-10
Unit Drawing	DGU1896-G103K
Liquid Valve	56605
Suction Valve	56604
Replacement Kit: Relay	K71-39
Replacement Kit: O/L	K90-59
Replacement Kit: St. Cap	K146-28
Replacement Kit: Run Cap	N/A

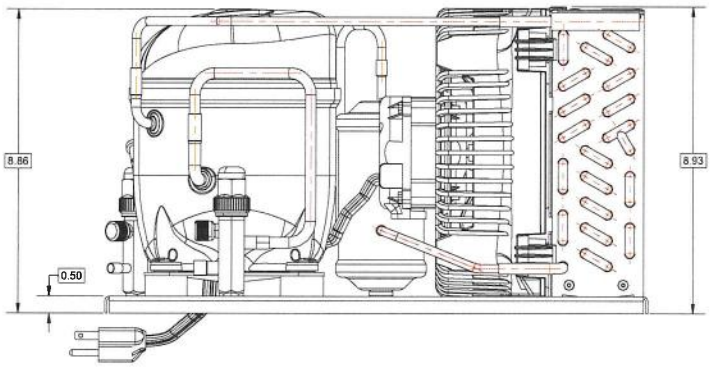
ITEM # 12

AE4425Z-AA1AS(x)_REV 1
TPC - July 17, 2013

CELSEON® LOW PROFILE CONDENSING UNIT

Model	**AE4425Z-AA1ASK, -SB, -SC, -SS**
BOM	**32F562-39S, -49S, -59S, -69S**
Air Cooled	**1/5 HP**
Application	**High/Commercial Temp**
Refrigerant	**R404A**
Volts-Hz-Ph	**115-60-1**





Model	Dimensions, inches (mm)			Line Connections		Pumpdown	AirFlow	Oil Ch.	Gross weight
	L	W	H	Suction	Liquid	90% @90°F	CFM	Oz.	Lbs. (Kg)
AE4425Z-AA1ASK	16 (406)	11.5 (292)	8.9 (226)	5/16" Sweat	1/4" Sweat	n/a	190	9.5	38.1 (17.3)
AE4425Z-AA1ASB						1.36			38.7 (17.6)
AE4425Z-AA1ASC				3/8" Valve Sweat	1/4" Valve Sweat				39.5 (17.9)
AE4425Z-AA1ASS						n/a			38.9 (17.6)

Factory charge 20 PSIG dry air, **MUST BE EVACUATED**

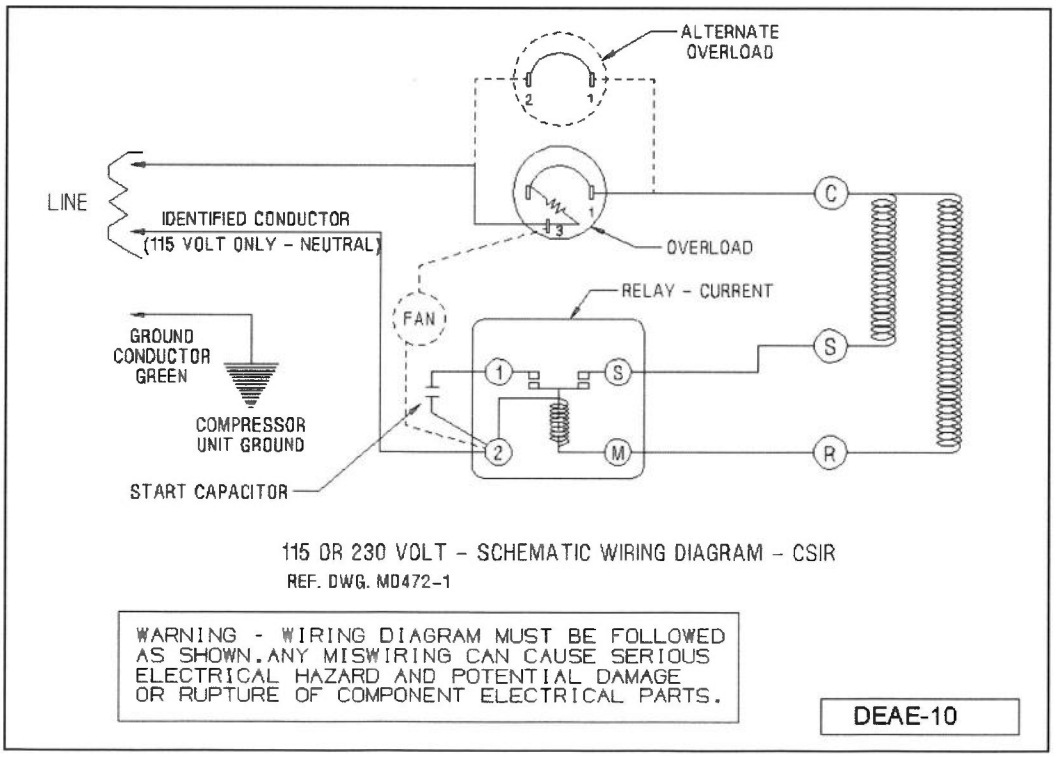
Evaporator		Ambient Temperatures															
		80°F				90°F				100°F				110°F			
T, °F	PSIG	BTUH	Watts	Head	Cond T	BTUH	Watts	Head	Cond T	BTUH	Watts	Head	Cond T	BTUH	Watts	Head	Cond T
-10	23.9	950	210	203	90	840	210	232	99	730	220	265	108	630	220	300	117
-5	28.2	1060	220	207	91	940	230	237	100	830	230	269	109	720	230	304	118
0	32.8	1190	230	212	93	1060	240	241	102	930	240	273	110	810	250	309	119
5	37.9	1340	250	217	94	1190	250	246	103	1060	260	279	112	920	260	314	121
10	42.4	1500	260	222	96	1340	260	252	105	1190	270	285	113	1040	280	320	122
15	48.2	1670	270	228	98	1500	270	258	106	1330	280	291	115	1170	290	327	124
20	**54.5**	**1850**	**270**	**234**	**100**	**1660**	**280**	**265**	**108**	**1480**	**300**	**298**	**117**	**1300**	**310**	**334**	**125**
25	61.2	2150	290	239	101	1950	300	270	110	1750	320	304	118	1550	330	342	127
30	68.4	2360	300	246	103	2140	310	277	112	1920	330	312	120	1710	340	350	129
35	76.1	2580	310	253	105	2340	320	285	114	2100	340	320	122	1870	360	358	131
40	84.4	2800	320	261	107	2540	330	294	116	2280	350	329	124	2020	370	368	133

Performance @ 60 Hz, Return gas 40°F below 20°F Evaporator and 65°F above 20°F evaporator, SubCooling 5°F

Parts/Specifications

Unit BOM	**32F562-39S**
Unit MODEL	**AE4425Z-AA1ASK**
Refrigerant	R404A
Refrigeration RANGE	-10°F to 40°F
Design Pressure Low	181
Design Pressure High	450
Volts - HZ - Ph	115V ~ 60HZ
Voltage Range	103.5 - 126.5
Min. Circuit Ampacity	5.7
Max. Fuse Size	15
Compressor MODEL	AE4425Z-AA1A
Compressor BOM	AE-1166-E
Compressor LRA	27
Compressor RLA	4.23
OverLoad	830-10053
Replacement Kit - O/L	
Relay	RP6008-ZR
Replacement Kit - Relay	
Run Capacitor	
Run Capacitor Rating	
Start Capacitor	85PS165D93
Start Capacitor Rating	270-324 MFD 165V
Unit drawing DGU	DGU1896-G103
Electrical Diagram	DEAE-10

Condenser	506-G333
Fan Guard	116-002P
Condenser, Fan Guard Kit	K135-02
Power Cord	85106-10
Fan Motor	NUT6B06ZUN301
Fan Blade	4VEA009
Replacement Fan Motor	6W115
Fan Motor, Blade, Guard assy	GFBG-106
Fan Motor RLA	0.41
Unit BOM	**32F562-49S**
Unit MODEL	**AE4425Z-AA1ASB**
Liquid Receiver	51085-1
Unit BOM	**32F562-59S**
Unit MODEL	**AE4425Z-AA1ASC**
Liquid Receiver	51085-1
Liquid Valve	56605
Suction Valve	56604
Unit BOM	**32F562-69S**
Unit MODEL	**AE4425Z-AA1ASS**
Liquid Valve	56605
Suction Valve	56604



ITEM # 12

BULLET®X Vacuum Pump

YELLOW JACKET®

The Quality You Have Come to Expect From a YELLOW JACKET® Vacuum Pump at an Affordable Price.

DOMESTIC	MODEL 93600
Free air displacement	7.0 cfm
Number of stages	2-stage rotary vane
Field blankoff	25 microns
Intake	1/4" x 3/8" x 3/8"
Motor	1/2 hp - 1725 rpm
Thermal overload protection	Yes
Voltage (single phase)	115V/60 Hz
Power cord	6' - motor mounted switch - U.S. plug
Oil capacity	28 oz. (0.828 L)
Dimensions	17.5" L x 6" W x 12" H (44.5 cm x 15.2 cm x 30.5 cm)
Net weight	31.7 lbs. (14.4 kg)
EXPORT	**EU/UK 93610; AU/NZ 93620**
Detachable ICE cord type	EU/UK AU/NZ
Free air displacement	200/165 L/M
Motor CE	1/2 hp - 1725/1425 rpm
Dual voltage (single phase)	115/230V/50-60 Hz
Dimensions	18" L x 6" W x 12" H (45.7 cm x 15.2 cm x 30.5 cm)
Net weight	34.5 lbs. (15.7 kg)

YELLOW JACKET® BULLET®X Vacuum Pump Capabilities Make it the Best Vacuum Pump for the Money.

Our newest generation adds characteristics that makes evacuating a system easier for years to come. The BULLET®X is available in 7 cfm to handle most residential and commercial applications. Pulling down to less than 25 microns, BULLET®X protects the system from contaminants and non-condensable gases, which can damage components, reduce efficiency and cause system failure.

The BULLET®X is a highly efficient, two-stage rotary vane, oil sealed pump that is rated to better than 25 microns. This upgraded BULLET®X design combines some of the same great features and benefits with enhancements to improve ergonomics and performance.

Features and Benefits

- Internal intake check valve to help prevent oil backup into the system during a power failure
- Intake filter screen keeps damaging particles from entering into the pump
- Heavy duty rotors and bearings
- Wide-mouth oil reservoir port for easier and cleaner filling. Doubles as a pump exhaust – threaded to attach a garden hose for exhausting to a remote location
- Large brass oil drain for easy access to fast oil changes
- Downward angled oil sump to remove contaminants usually trapped in other sump designs
- Heavy duty steel handle
- Two-year warranty
- Made in USA

Enhancements

- Integrated cooling fins to cool pump and increase performance
- Oil suck-back valve improvement
- Elongated oil sight glass – easier to see oil level

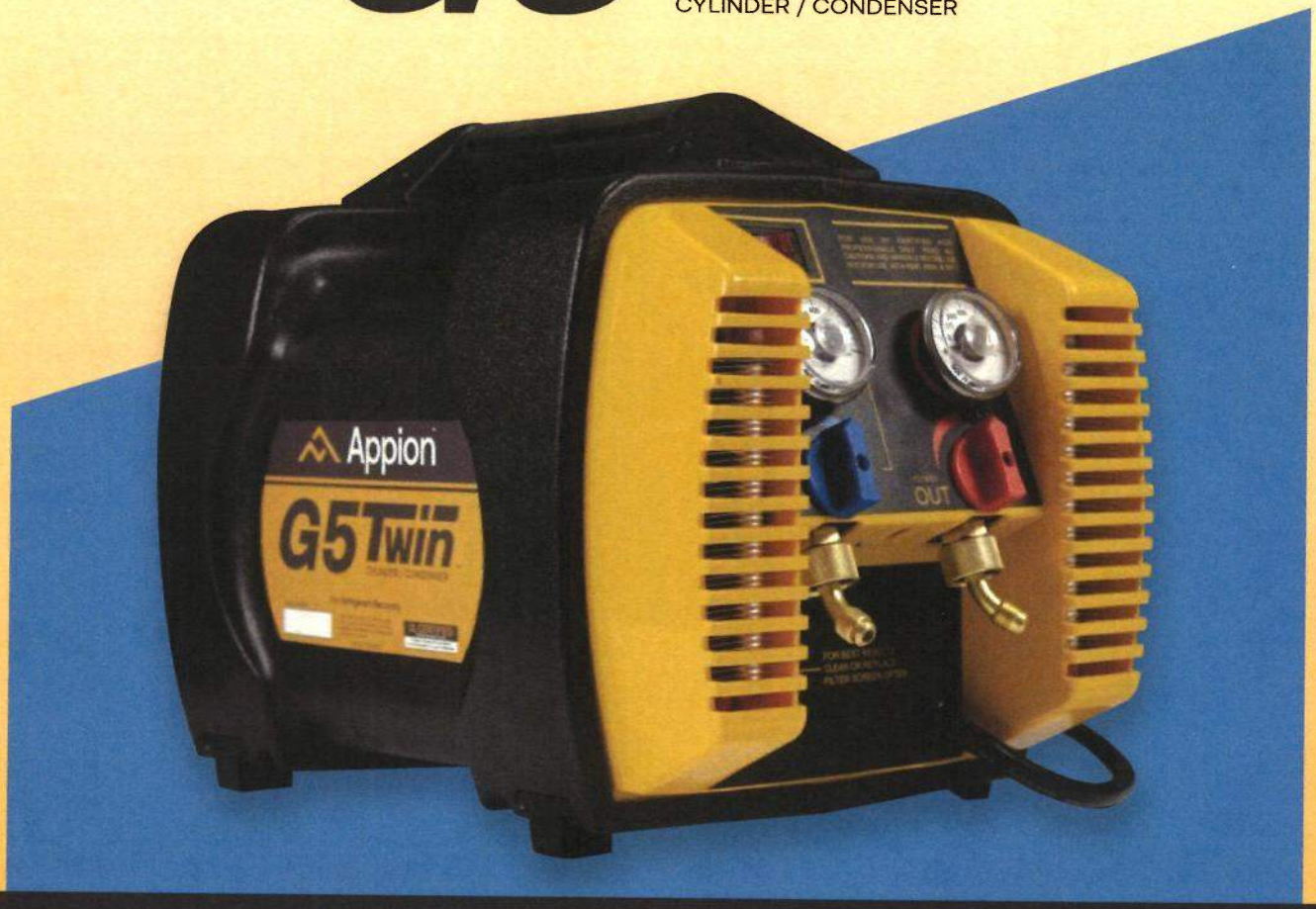
Appion

G5Twin™

CYLINDER / CONDENSER

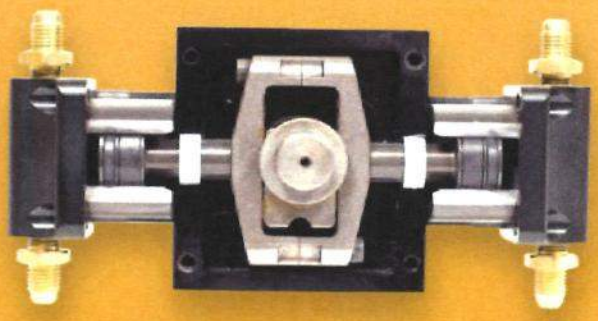
ITEM # 14

Recovery



Automatic **Liquid** and **Vapor** Recovery

4x *Faster*



Up to 4x Faster **Certified Recovery Rates** compared to other units in its class

Refrigerant-Isolated Crankcase for Maximum Reliability

Part# **G5Twin**

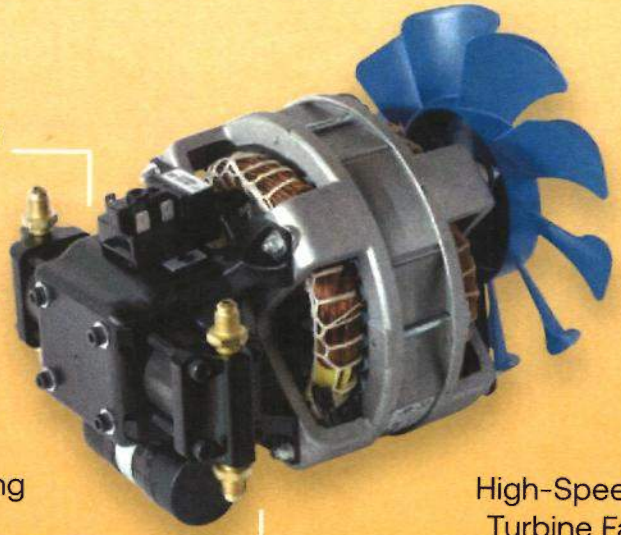
Appion

High-Speed **Industrial** Recovery

Appion

The G5Twin is designed to reliably pump liquid without any need for throttling, cutting down on overall recovery time.

The G5Twin is built with a high-efficiency motor and compressor along with massive airflow. This design allows for maximum pumping performance and cooling efficiency for the fastest refrigerant recovery.



- Patented Opposing **Twin Cylinders and Twin Condensers** for ultra-fast recovery
- **Permanently-lubricated, bearing-lined crankcase** is isolated from refrigerant, eliminating bearing contamination
- Pumps **Liquid and Vapor** with no throttling
- 7-inch, 10-blade turbine fan blasts over **700 cfm of cooling air** over the twin condensers and twin cylinder heads

G5Twin Recovery Rates (per min)

Refrigerant	Liquid	Vapor
R134a	10.14 lb* 4.60 kg*	0.46 lb** 0.21 kg**
R-22	10.36 lb 4.70 kg	0.62 lb 0.28 kg
R-407C	11.93 lb 5.41 kg	0.5 lb 0.25 kg
R410A	17.20 lb 7.80 kg	0.55 lb 0.25 kg

*Using high-speed direct liquid mode; 8.16 lb / 3.7 kg with standard recovery
** With external cooling accessory; 0.44 lb / 0.20 kg with standard recovery

G5Twin	Product Specifications
Dims	11.38 in x 10.30 in x 9.40 in 289 mm x 262 mm x 239 mm
Weight	24 lbs 11 kg
Power	115 VAC, 60 Hz, 10 Amps Int'l: 230 VAC, 50 Hz, 5 Amps

Learn More At
AppionTools.com/G5Twin

GRAINGER

ITEM # 14

Products Based on Your Search

JB INDUSTRIES
Refrigerant Evacuation...

Compare

Web Price
$598.08 / each

JB INDUSTRIES
Refrigerant Evacuation...

Compare

Web Price
$1,055.32 / each

JB INDUSTRIES
Refrigerant Evacuation...

Compare

Web Price
$473.61 / each

Related Categories

Refrigerant Evacuation Pumps

Air Conditioning and Refrigeration Tools

Air Conditioning Chemicals, Tools and Accessories

JB INDUSTRIES Refrigerant Evacuation Pump: 7 cfm Displacement, 1/2 hp HP, 15 micron, 31 lb Wt

Item **1RK23** Mfr. Model **DV-200N**

Compare

Web Price
$795.38 / each

Qty 1 Add to Cart

Ship | Pickup

Expected to arrive
Wed. Nov 01.

Ship to **08054** | Change

Shipping Weight **31 lbs**

Ship Availability Terms

Add to List

Product Details

Catalog Page 3007

Displacement **7 cfm**

HP **1/2 hp**

Inlet Port Size **1/4 in and 1/2 in Flare; 3/8 in**

Voltage **115V AC**

Amps AC **7.5 A**

Hz **60 Hz**

End Vacuum **15 micron**

Overall Length **14-1/2 in**

Overall Height **12 in**

Overall Width **5-5/8 in**

Weight **31 lb**

Oil Capacity **21 oz**

Cord **6 ft**

Body Material **Aluminum**

Includes **Blank Off Check Valve; Oil Sight Glass**

UNSPSC **40151502**

Country of Origin **USA (subject to change)**

Documents

- JB Industries Platinum Vacuum Pump Brochure
- JB Industries Platinum Pump Repair Parts List
- JB Industries Platinum Pump Instruction Manual
- JB Industries Platinum Pump Spanish Instruction Manual
- JB Industries Platinum Pump French Instruction Manual
- JB Industries Platinum Pump Arabic Instruction Manual
- JB Industries Platinum Series Vacuum Pump 1RK23 1RK24 Replacement Parts List
- JB Industries Platinum Vacuum Pumps OIPM

Compatible Products

Alternate Products

ITEM # 14

TEZ New Generation "D" Condensing Units

PRODUCT DATA & SPECIFICATIONS

Bulletin T40-TEZD-PDS-9
Part # 1108862

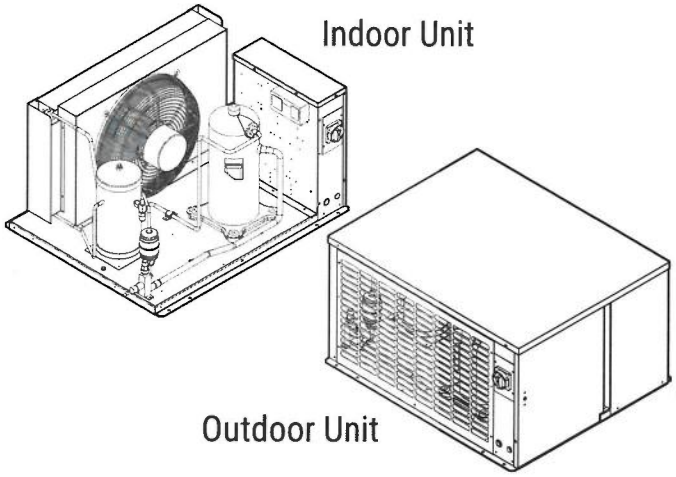
PRODUCT SUPPORT
web: **www.t-rp.com/tez**
email: **smcu@t-rp.com**
call: **1-844-893-3222 x521**
scan:

60 Hz

Indoor/Outdoor Air-Cooled Scroll Condensing Units

3/4 to 17 HP -
High and Low
Temperature Refrigeration

INCLUDES MODELS FOR DOE & NRCAN
AWEF-COMPLIANT APPLICATIONS

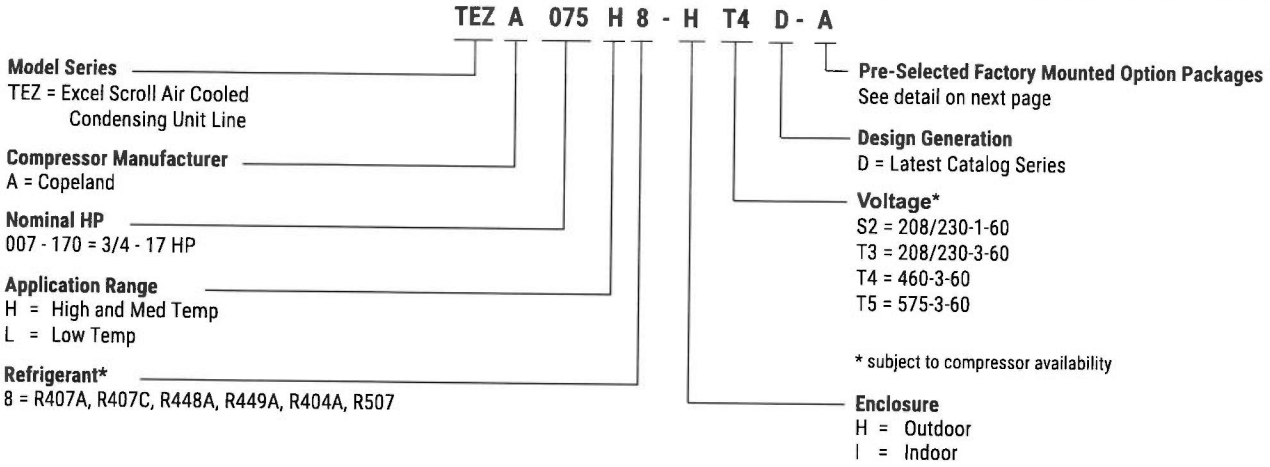


SMARTSPEED™
FAN MOTOR TECHNOLOGY
See Page 4 for details

LIMITROL
FLOATING HEAD PRESSURE CONTROL SYSTEM
See Page 5 for details

CONTENTS

NOMENCLATURE



STANDARD FEATURES

Indoor Unit:

- Compatible with Low GWP Refrigerants
- Weatherproof electrical control box with compressor contactor and fused control circuit
- Copeland scroll compressor
- High efficiency enhanced tube and fin condenser design
- SmartSpeed EC Fan Motor Technology standard on models using chassis 1 (see page 35)
- Energy efficient PSC condenser fan motor on models using chassis 2 thru 6 (see page 35)
- Receiver with fusible plug and liquid shut off valve
- Suction service valve
- Pre-formed copper tubing
- Liquid injection (low temp. models)
- Unit leak tested and shipped with helium holding charge
- Fixed high pressure switch and adjustable low pressure control
- Receiver inlet valve on 2-fan units models only
- Discharge thermostat on applicable models only
- Painted cabinet
- Time delay relay for compressor
- QuickVac Evacuation and Refrigerant Recovery Valves

Outdoor Unit: All Standard Features of Indoor Unit, Plus:

- Painted weather-resistant housing with removable hood
- Flooded head pressure control (adjustable)
- Crankcase heater
- Fan cycling control with flex hose (2 fan units)

AVAILABLE OPTIONS

- Suction accumulator with and without boil-out coil
- Discharge line check valve
- Oil separator with and without oil return filter and solenoid valve
- Receiver inlet ball valve
- Heated and Insulated receiver
- Over-sized receiver
- Sealed liquid line filter drier & sight-glass
- Ball valve - liquid line (shipped loose)
- Insulated suction lines
- Leg kits
- Discharge air hood
- Sub cooling circuit on 5 - 17 HP models
- Liquid line solenoid valve (with standard 230 volt coil) - shipped loose
- Variable speed EC motors as head pressure control (see Bulletin T40-HPC-AG or https://docs.t-rp.com/1101111.pdf for details)
- Dual pressure control with flex hoses
- Compressor circuit breaker
- Current sensing relay - for use with oil safety control (where applicable)
- Defrost heater contactor c/w fuse block
- Evaporator fan contactor c/w fuse block
- Disconnect switch
- Disconnect fusing
- Pump down toggle switch
- Lock out control circuit relay
- Mechanical time clock
- Electronic voltage / Phase monitor
- **SmartSpeed Fan Motor Technology on models using chassis 2-6 (see page 4)**
- **Limitrol+ Floating Head Pressure Control System (see page 5 or Bulletin T40-LIMITROL-AG or docs.t-rp.com/1101114.pdf for details)**

TPLP New Generation "D"
Pre-Assembled ITEM # 14
Low Profile Evaporators

PRODUCT DATA & INSTALLATION

Bulletin T30-TPLPD-PDI-2E
Part #1109294

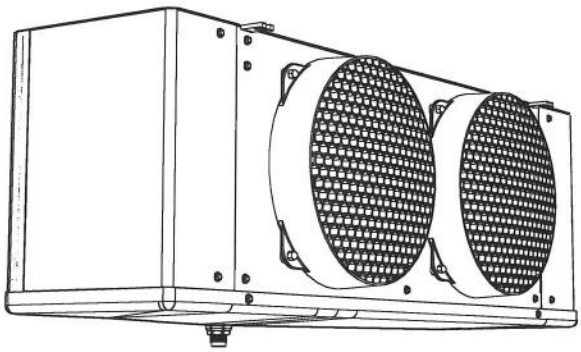
PRODUCT SUPPORT
web: **www.t-rp.com/tplp**
email: **evaps@t-rp.com**
call: **1-844-893-3222 x520**
scan:

Air & Electric Defrost

Medium Temperature Applications: 35°F
Low Temperature Applications: -10°F

Electrical: 115/1/60, 208-230/1/60, 208-230/3/60

INCLUDES MODELS FOR DOE & NRCAN
AWEF-COMPLIANT APPLICATIONS



INCLUDES RATINGS FOR
LOW GWP
REFRIGERANTS

SMARTSPEED™ FAN MOTOR TECHNOLOGY
STANDARD ON ALL MODELS

ESP+
see page 12 for details

CONTENTS

NOMENCLATURE

TP LP 3 16 L E S2 D R8 - ESP

Pre-Assembled

Low Profile Evaporator

Number of Fans

Nominal Capacity:
x 1000 @ 10°F TD, Btu/H, R404A

Application Range:
M = Medium to High Temp 6 FPI (25°F / -4°C) Evap Temp)
L = Low Temp 6 FPI (-20°F / -29°C) Evap Temp)
V = Low Temp 4 FPI (-20°F / -29°C) Evap Temp)

Defrost:
A = Air E = Electric

Voltage:
S1 = 115/1/60
S2 = 208-230/1/60 T3 = 208-230/3/60

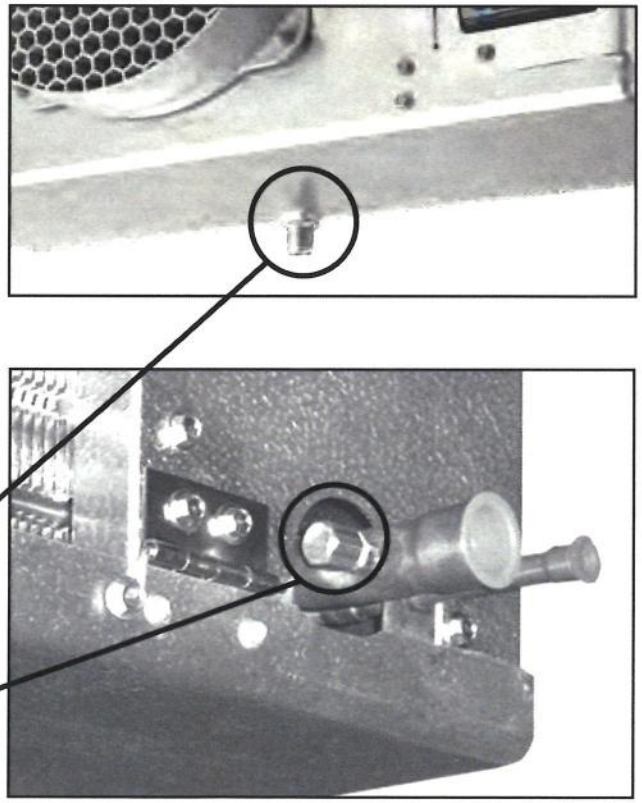
Design Generation

Refrigerant Designation:
R2 = R407A / R407C / R448A / R449A
R6 = R404A
R8 = R407A / R407C / R448A / R449A, R404A
(R8 applies to ESP+ models only)

Designation:
ESP = ESP+

STANDARD FEATURES

- EC motors with patented SmartSpeed® Technology
- Compatible with Low GWP Refrigerants
- High efficiency and high strength fan guard
- Front access
- Internally enhanced tubing
- Convenient mounting brackets
- Ample electrical and header compartments
- Positive slope, hinged drain pan
- Centrally located, universal drain connection
- Large 3/4" ID (3/4" MPT) drain hole
- Schrader valve on suction header, located outside of cabinet



ESP+ (R8) MODELS

Include factory installed:

- ESP+ Adaptive Defrost Control
- ESP+ Remote Display
- EEV Electronic Expansion Valve
- Solenoid Valve

ELECTRO-MECHANICAL (R2 and R6) MODELS

Include factory installed:

- TX Valve
- Solenoid Valve
- Thermostat

R407A R407C R448A R449A

Medium Temperature - 6 FPI Models

Model TPLP	Qty. Fans	Evaporator Temperature Selection Capacity BTU/h			Air Flow		Refrig. Charge R407A **	
		20/25°F *(-4/-7°C)*	15°F *(-9°C)*	10°F *(-12°C)*	CFM	L/S	LB.	*KG*
104M	1	4310	4270	4220	750	*350*	0.7	*0.3*
106M		5910	5850	5790	705	*330*	1.1	*0.5*
107M		7000	6930	6860	680	*320*	1.5	*0.7*
209M	2	8700	8610	8530	1500	*710*	1.3	*0.6*
211M		11400	11300	11170	1410	*670*	1.4	*0.6*
214M		13700	13600	13430	1360	*640*	2.0	*0.9*
317M	3	16900	16700	16560	2115	*1000*	3.0	*1.4*
320M		20300	20100	19890	2040	*960*	4.0	*1.8*
422M	4	22400	22200	21950	2820	*1330*	3.3	*1.5*
427M		27000	26700	26460	2720	*1280*	3.9	*1.8*
534M	5	33700	33400	33030	3400	*1600*	6.5	*2.9*
640M	6	40400	40000	39590	4080	*1930*	7.8	*3.5*

- Capacities at other TD within a range of 8 to 15 °F *(4.4 to 8.3°C)* are directly proportional to TD, or use formula: Capacity = Rated capacity ÷ 10 x TD.

** For R448A/R449A, use conversion factor 0.96

R404A R507

Medium Temperature - 6 FPI Models

Model TPLP	Qty. Fans	Evaporator Temperature Selection Capacity BTU/h			Air Flow		Refrig. Charge R404A R507	
		20/25°F *(-4/-7°C)*	15°F *(-9°C)*	10°F *(-12°C)*	CFM	L/S	LB.	*KG*
104M	1	4200	4160	4120	750	*350*	0.6	*0.3*
106M		5770	5710	5650	705	*330*	1.0	*0.5*
107M		6830	6760	6690	680	*320*	1.4	*0.6*
209M	2	8500	8420	8330	1500	*710*	1.2	*0.5*
211M		11100	10990	10880	1410	*670*	1.3	*0.6*
214M		13300	13200	13030	1360	*640*	1.8	*0.8*
317M	3	16600	16400	16270	2115	*1000*	2.8	*1.3*
320M		19800	19600	19400	2040	*960*	3.7	*1.7*
422M	4	21800	21600	21360	2820	*1330*	3.0	*1.4*
427M		26400	26100	25870	2720	*1280*	3.6	*1.6*
534M	5	32900	32600	32240	3400	*1600*	6.0	*2.7*
640M	6	39400	39000	38610	4080	*1930*	7.2	*3.3*

The above capacities were rated based on nominal 10°F TD

Capacities at other TD within a range of 8 to 15 °F *(4.4 to 8.3°C)* are directly proportional to TD, or use formula: Capacity = Rated capacity ÷ 10 x TD.

ITEM # 15

The new degree of comfort.™

Commercial Renaissance™ Line Package Gas Electric Units

RGECZT *Commercial Prestige®* Series

Nominal Size 6 Tons
ASHRAE 90.1 2016 Compliant Models

RGECZR *Commercial Classic®* Series

Nominal Sizes 3, 4 & 5 Tons
ASHRAE 90.1 2016 Compliant Models

ISO 9001:2015 c UL us LISTED

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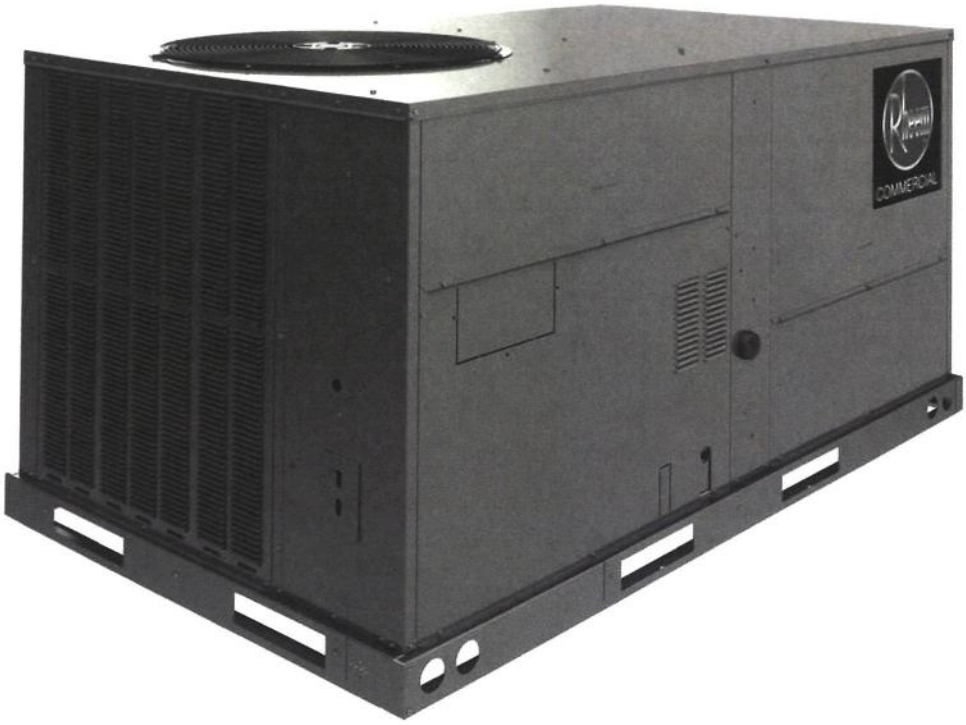

RGEC STANDARD FEATURES INCLUDE:

- Factory charged with R-410A HFC refrigerant
- Wired and run tested
- Scroll compressors with internal line break overload and high pressure protection
- Convertible airflow – vertical down flow or horizontal side flow
- Forkable base rails for easy handling and lifting
- Cooling operation up to 125°F ambient
- Two-stage gas heat input with direct spark ignition system, solid state furnace controls, and optimized induced draft combustion
- MicroChannel evaporator and condenser coil
- PlusOne® ServiceSmart package includes:
  Qwik-Change Flex-Fit Rack™
  Qwik-Slide Blower Assembly™
  Qwik-Clean Drain Pan™
- Overflow condensate sensor
- PlusOne® Diagnostics with Dual 7-Segment LED Display to meet code compliance
- One-piece top cover and base pan with drawn supply and return opening
- Two-piece control door
- ¼ turn fasteners on filter access door
- Color-coded and labeled wiring
- External lockable gauge ports
- TXV refrigerant metering system
- Solid-core liquid line filter drier
- High pressure and low pressure/loss of charge protection with built-in Smart Logic
- Insulation encapsulated throughout entire unit
- New product footprint with matching connections
- Improved factory lead times
- 6 Ton includes a single 2-Stage compressor
- 3-5 Ton includes one single-stage compressor
- MERV 8 (RXMF-M08A21616) & MERV 13 (RXMF-M13A21616) filters are available as an accessory

FACTORY INSTALLED OPTIONS:

- Louvered panels
- Hinged access doors
- Stainless steel heat exchanger (20 year warranty)
- Low ambient/freeze stat
- Non-powered convenience outlet
- Unfused disconnect
- Circuit breaker
- Economizer (Title 24 and ASHRAE 90.1 2016 compliant)
- Supply and return smoke detector
- Return smoke detector
- ElectroFin® E-Coat for Microchannel Condenser Coil Coating
- ClearControl™ Direct Digital Control (DDC)
- Comfort Alert Phase-monitor Protection
- Vertical Economizer

FIELD INSTALLED ACCESSORIES:

Accessory	Model Number	Factory Installation Available?
Economizer w/Single Enthalpy (Downflow/Vertical)	RXRD-01MCDAM3	Yes
Economizer w/Single Enthalpy (Horizontal)	RXRD-01MCHAM3	No
Economizer-w/Single Enthalpy (Downflow/Vertical) DDC	RXRD-01MCDBM3	Yes
Economizer w/Single Enthalpy (Horizontal) DDC	RXRD-01MCHBM3	No
Dual Enthalpy Kit	RXRX-BV01	No
Dual Enthalpy Kit DDC	RXRX-BV02	No
Power Exhaust (230V) Vertical	RXRX-CCF02C	No
Power Exhaust (460V) Vertical	RXRX-CCF02D	No
Power Exhaust (230V) Horizontal	RXRX-CCF03C	No
Power Exhaust (460V) Horizontal	RXRX-CCF03D	No
Manual Fresh Air Damper	RXRF-ACA1	No
Motorized Fresh Air Damper	RXRF-ACB1	No
Roofcurb, 14"	RXKG-DCC14	No
Roofcurb, 24"	RXKG-DCC24	No
Roofcurb Adapter	RXRX-DCCAE	No
Roofcurb, 14" Welded	RXKG-DC14	No
Roofcurb, 24" Welded	RXKG-DC24	No
MERV 8 Filter	RXMF-M08A21616	No
MERV 13 Filter	RXMF-M13A21616	No
Concentric Diffuser 3-4 Ton Flush	RXRN-AEF1800	No

Accessory	Model Number	Factory Installation Available?
Concentric Diffuser 5-6 Ton Flush	RXRN-AEF2000	No
Concentric Diffuser 3-4 Ton Drop	RXRN-AED1800	No
Concentric Diffuser 5-6 Ton Drop	RXRN-AED2000	No
Concentric Adapter 3-4 Ton Drop	RXMC-DC01	No
Concentric Adapter 5-6 Ton Drop	RXMC-DC02	No
Outdoor Coil Louver Kit	RXRX-ADD04C	Yes
Nonpowered Convenience Outlet	RXRX-BN01	Yes
Unfused Service Disconnect	RXRX-BP01	Yes
Comfort Alert (1 Phase) DDC	RXRX-AZ03	Yes
Comfort Alert (1 Phase) Non-DDC	RXRX-AZ04	Yes
Comfort Alert (3 Phase) DDC	RXRX-AZ01	Yes
Comfort Alert (3 Phase) Non-DDC	RXRX-AZ02	Yes
Carbon Dioxide Sensor (Wall Mount)	RXRX-AR02	No
BACnet Communication Card	RXRX-AY01	No
LonWorks Communication Card	RXRX-AY02	No
Room Humidity Sensor	RHC-ZNS4	No
Room Temperature and Relative Humidity	RHC-ZNS5	No
Low-Ambient Control Kit	RXRZ-A04	Yes
Freeze Stat Kit	RXRX-AM05	Yes
Return Smoke Detector (Field kit)	RXRX-BS01	No
Return/ Supply Smoke Detector (Field kit)	RXRX-BS02	No

SECTION 15015 – GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 SCOPE

1. The General, Supplementary, and Special Conditions, Applicable portions of all divisions and the addenda thereto, are made a part of this Contract.

2. All work described in these specifications shall be the responsibility of the plumbing contractor unless otherwise indicated.

3. It is the intent of these specifications to include all material, service and labor necessary to form a complete and properly operating whole.

1.02 CONTRACT DRAWINGS

1. Examine all drawings and specifications and visit the site to become acquainted with the construction and the extent of the work.

2. In referring to drawings, figured dimensions take precedence over scale measurements. Discrepancies must be referred to the Engineer for decision. Each Contractor shall certify and verify all dimensions before ordering material or commencing work.

3. Any work called for in the specifications, but not mentioned or shown on the drawings, or called for on the drawings, but not mentioned in the specifications, shall be furnished as though called for in both.

4. When any device or part of equipment is herein referred to as a singular number, such as "the pump" such reference shall be deemed to apply to as many such devices as required to complete the installation.

5. The term "provide" shall mean "furnish and install". Neither term will be used generally in these specifications but will be assumed. The term "furnish" shall mean to obtain and deliver on the job for installation by other trades.

1.03 CODES AND STANDARDS

1. All work shall comply with all regulations and be subject to inspection and approval of authorities having jurisdiction.

2. Where items indicated on contract documents differ from code requirements, contractor shall inform engineer prior to installation. Any construction installed by contractor that is not in compliance with applicable codes, shall be removed, modified, and/or replaced at not additional cost.

3. All equipment shall be labeled by an approved agency.

4. Contractor shall give all notices, obtain and pay for all permits, deposits, and fees necessary.

5. Manufacturer's published data is made a part of these specifications.

6. Wherever a recognized national organization has published standards these shall be complied with (such as ASA Z 21.30 for gas piping).

1.04 REJECTED MATERIALS

1. See Specification Section 01300-Submittals and the AIA Document A201-2017 General Conditions of the Contractor for Construction.

1.05 WORKMANSHIP

1. See AIA Document A201-2017 General Conditions of the Contractor for Construction.

1.06 SHOP DRAWINGS

1. See Specification Section 01300-Submittals.

1.07 AS-BUILT DRAWINGS

1. See Specification Section 01700-Project Closeout.

1.08 WARRANTY

1. See Specification Section 01740-Warranties and Bonds.

1.09 FIRE RATING

1. All materials used anywhere in the work must have N.F.P.A. rating as follows:

   A. Flame Spread - Not Over 25
   B. Smoke Developed - Not Over 50
   C. Fuel Contributed - Not Over 25

2. All materials shall be "Self Extinguishing".

1.10 EQUIPMENT SELECTION AND SERVICEABILITY

1. All equipment shall be located and installed so that it may be serviced. Demonstrate that there is room to remove all tube bundles, motor and similar equipment. Equipment which is too large or poorly located to permit servicing shall be replaced or repositioned at no additional cost to the Owner.

2. Where piping or control diagrams or sequencing differ from the recommended piping arrangements of the equipment manufacturer, and will directly affect the equipment performance, the manufacturer's recommendations shall be submitted in writing to the Architect/Engineer for approval, prior to purchasing the equipment involved. This Contractor shall be responsible for obtaining such recommendations from the manufacturers in order to effect correct and perfect operation of the equipment at the capacities and temperatures indicated.

1.11 EQUIPMENT FURNISHED BY OTHER TRADES

1. All equipment furnished and/of installed by other trades requiring connections and services by this Contractor shall have such services provided.

2. This Contractor shall verify exact requirements with shop drawings.

3. This Contractor shall verify all locations, sizes, requirements of services required for equipment in field with Contractor furnishing equipment.

1.12 FIRE SAFING

1. Provide fire safing and duct safing per 2018 IBC New Jersey edition. Proseal Systems - Proseal plug device or approved equal per 93 UL Directory, No 545, F rating for precast concrete. 3M Brand Fire Barrier CP25WB or approved equal and caulk CAJ 1044 and CAJ 5001, WL1003, WL5011, or approved equal.

1.13 EQUIPMENT TO BE **FURNISHED BY OWNER**

1. All equipment which shall be furnished by the Owner will be identified throughout the plans and specifications as "**FURNISHED BY OWNER**".

2. The equipment **FURNISHED BY OWNER** is the equipment located in the HVAC shop that is used for instructional purposes only. All HVAC equipment associated with the building systems shall be furnished and installed by contractor.

3. The equipment **FURNISHED BY OWNER** is equipment that is to be used for instructional purposes. The equipment shall be installed with all appurtenances for an operating system.

4. The ancillary equipment and materials (pipes, flues, duct, etc.) shall be installed to allow for the equipment to be operated. Further, wherever possible, the ancillary systems shall be installed so that it may be easily disassembled and assembled in the future as part of the circulation.

5. The Owner shall be responsible for furnishing the following:

   - Purchasing the Specified Equipment and/or Contractor Services indicated on plans and specifications as "**FURNISHED BY OWNER**". Refer to plans and specifications for **FURNISHED BY OWNER** equipment submittals submitted by the Equipment Manufacturers. Refer to plans and specifications for additional **FURNISHED BY OWNER** scope of work provided by the design team as required to provide further clarity or provide corrections due to omissions or errors by the Equipment Manufacturer's submittals.

6. For equipment **FURNISHED BY OWNER**, this CONTRACTOR shall be responsible (in all aspects) for providing the following. The following list is a guide and reference exclusion of any item does not relieve contractor from providing a fully functional and operational system. Commissioning, balancing and installation per specifications.

   - Inspect all material upon arrival.
   - Reviewing and complying with all manufacturer's recommendations.

- Coordinating all aspects of equipment's' installation, including but not limited to: layout, code compliance, roof penetrations, electrical requirements and protection from weather.
- This Contractor is responsible for all installation of all equipment and accessories furnished by Owner and/or by this Contractor.
- Furnish and install all specified all Gas Piping and Specialties (booster, regulator, etc.) as indicated on plans and specifications.
- Provide Cleaning of equipment.
- Provide all other pertinent services required for proper operation of the above specified equipment installed by this contractor.
- This Contractor shall verify locations, sizes and requirements of all services to equipment, in field with the Owner prior to construction.

PART 2 PRODUCTS

2.01 ELECTRICAL EQUIPMENT

1. This Contractor shall furnish all his equipment complete with motor, controllers, capacitors and starting equipment.

2. Electric motors shall be open, drip proof induction motors rated for continuous duty at 15% overload with 40° C. rise; single phase motor shall be capacitor start-induction run. Motors one-half horsepower shall be single phase, unless otherwise noted (c.f. Division 16). Starting of magnetic across-the line starters equivalent to Furnas Bulletin 14 or approved equal, unless otherwise specified. Thermal overload type, motor rated manual switches shall be furnished for motors ¾ HP and less which do not require magnetic starters for control purposes.

3. Provide Power Factor correction capacitors size to increase full load power factor to 95%. Capacitors shall be fused, in NEMA enclosure, connected between safety switch and motor starter.

4. Where apparatus is specified as "Packaged", all electrical equipment shall be furnished, set and wired to a single point of connection for apparatus as a unit.

5. This Contractor shall set all electrical equipment furnished by him unless same is to be mounted on an electrical panel board, junction box or similar piece of electrical equipment and is to be wired by others.

6. Where electrical characteristics are not shown, all electrical characteristics shall be as indicated on electrical plans. Where there is a conflict between model numbers which indicate electrical characteristics and electrical drawings, the electrical drawings shall take precedent.

7. This Contractor shall verify all electrical characteristics of all equipment with electrical contractor. This Contractor shall submit to electrical contractor location of all motor, starters, other electrical equipment voltage and phase required prior to submission of this Contractors' and electrical contractors' shop drawings.

8. Should this Contractor change type of equipment which results in change to electrical characteristics, then this Contractor will be responsible to coordinate these changes with all other trades and pay for all required changes.

9. Should this Contractor change electrical characteristics of equipment from that shown on electrical drawings, he is responsible for any extra cost resulting from such change.

2.02 ELECTRICAL WIRING

1. This Contractor shall furnish and install all electric wiring required for his contract, with the exception of certain wiring shown under Division 16.

2.03 RELIEF VALVES

1. Provide ASME labeled relief valve on each closed fluid system, set to relieve full code capacity at design pressure. Pipe discharge to closed drain or approved receptor.

2.04 THERMOMETERS

1. Thermometers shall be 5" diameter dial type with stainless steel cases and separate wells. Ashcroft T-7173T or approved equal, adjustable to any angle.

2.05 TAGS

1. This Contractor shall provide a 2" diameter brass tag with stamped service designation and numbers, fastened to each valve with brass chain and "S" hook.

2. Each control, starter, disconnect switch, etc., shall be provided with ¾" x 2½" metal name tag securely fastened to device.

3. Omit name tags on controls exposed in finished spaces.

PART 3 EXECUTION

3.01 METHOD OF PROCEDURE

1. The drawings accompanying these specifications are diagrammatic and intended to cover the approximate and relative locations of the system.

2. Installation, connection and interconnection of all components of these systems shall be complete and made in accordance with the manufacturer's instructions and best trade practices. This Contractor shall erect all parts of equipment to be furnished by him under his Contract at such time and in such manner as not to delay or interfere with other Contractors.

3. This Contractor shall lay out his work and be responsible for the establishment of heights, grades, etc., for all interior and exterior piping, drains, fixtures, conduit, etc., included in Contract Documents, in strict accordance with the intent expressed thereby; and all the physical conditions to be met at the building and finished grade, and shall be responsible for accuracy thereof. The establishment of the location of all work shall be performed in consideration of the finished work. In case of conflict, equipment and/or materials shall be relocated without cost to the Owner, as directed by the Architect, regardless of which equipment was installed first.

4. This Contractor shall cooperate with other contractors for the proper securing and anchoring of all work included within these specifications. Extraordinary care shall be used in the erection and installation of all equipment and materials to avoid marring surfaces of the work of other trades, as this Contractor will be held financially responsible for all such damage caused by the lack of precaution and due to negligence on the part of his workmen.

5. Do not run pipe or conduit for plumbing systems in any concrete slab 3" or less in thickness. Do not place any pipe or conduit in any slab where the outside diameter of the pipe or conduit is more than one-quarter the thickness of the slab.

6. All piping, conduit and other plumbing materials and equipment shown to be mounted below ceilings are to be kept as close to ceiling areas as possible unless otherwise noted.

7. Items such as valves, cleanouts, etc., that will be concealed in construction shall be installed and so arranged as to be fully accessible for adjustment, service and maintenance.

3.02 VISIT TO SITE

1. Due to the nature of the work involved under this Contract, all bidders are required to thoroughly examine the site. Bidding contractors shall thoroughly review Contract Documents prior to visiting the site, take Contract Documents to site and thoroughly explore to any extent necessary, the existing conditions relating to fulfilling the requirements of this Contract.

2. If discrepancies are noted between requirements of Contract Documents and existing conditions, this Contractor shall so indicate to architect during bidding period and receive clarification before bidding. Failure to comply with this requirement will result in Architect's interpretation during the construction period and architect's decision will be final and binding as the sole interpreter of the Contract requirements.

3. Extras will not be considered for any work relating to connections with existing systems or adaptability of new systems to existing structures.

3.03 CLEANING

1. Upon completion of the work, this Contractor shall remove all excess material, debris, tools and equipment from the site, and leave the premises in a broom clean condition.

2. Flush out all piping systems with proper solvents to insure removal of all foreign materials. Clean fixtures, equipment, piping and other surfaces soiled by the work. Remove debris and rubbish on a daily basis.

3.04 START-UP AND ADJUSTMENTS

1. After all testing is complete, start each system and make final adjustments for proper flow, temperature and quietness of operation. Record all final results including flows, balance settings, temperature adjustments, pertinent notes and recommendations. Furnish copies of report for review and record.

2. Report shall show actual data as recorded. Variations are expected due both to "normal" variations in field readings and to settings deliberately made to achieve proper operating conditions rather than design guidelines. Correct operation and maintained conditions will be sufficient evidence of proper setting.

3.05 OPERATING AND MAINTENANCE INSTRUCTIONS

1. This Contractor shall prepare complete sets of bound operating and maintenance instructions including valve chart framed under glass or laminated with clear plastic mounted on masonite board, indicating number, location and purpose of each valve. Two (2) charts and one (1) mylar copy shall be provided for each mechanical room or as designated. The instructions prepared shall be black on white and shall be complete enough so that men generally familiar with the type of system will need no further data to properly perform the indicated procedures.

2. This Contractor shall furnish qualified personnel to instruct the Owner in the operation of the system and must request from the Owner, in writing, a date for such instruction to begin. Contractor's personnel shall remain until such instruction is complete to Owner's satisfaction. Contractor shall receive from Owner written verification that the Owners personnel have been thoroughly instructed in the operation, maintenance and all facets of the system operation.

3. Manuals shall include all equipment, equipment parts lists, complete oiling, recommend spare parts, complete coiling, cleaning and servicing data compiled in a clearly indexed and easily understood form the data shall indicate the serial numbers of each piece of equipment and provide complete lists of replacement parts motor parts ratings and actual loads.

4. Provide operating instructions shall include wiring and control diagrams showing complete lay out of each system.

5. Any special emergency operating instructions and a list of service organizations (including addresses and telephone numbers) capable of rendering emergency service to the various parts of the system.

6. ASME and State pressure vessel inspection forms, all motor data, including standard and actual operating in service data, and copies of all manufacturer's equipment, guarantees and warranties.

7. Provide separate manuals, reports, instructions, etc. for each school.

3.06 PAINTING AND FINISHING

1. All painting is to be done in accordance to Rust-Oleum Corporations or approved equal printed instructions. All surfaces to receive two (2) coats of primer, exposed surfaces one (1) finished coat. Aluminum or galvanized metal surfaces are considered finished where concealed.

2. All surfaces to be carefully cleaned and/or pickled and filled as required to provide a proper uniform surface. Factory finished equipment shall be touched up or refinished where required.

3.07 CONSTRUCTION SAFETY

1. All work shall be done in accordance with the following Federal regulations:

   A. Williams-Steiger Occupational Safety and Health Standards, Chapter XVII of Title 29, Codes of Federal Regulations.

2. Comply with local Health and Safety Regulations.

3.08 ENERGY CONSERVATION CODES

1. It is the intent of this specification that all equipment and materials furnished meet the latest enforced edition of the Energy Code or such code as locally applicable, if more restrictive.

3.09 FLASHINGS

1. All piping passing through roofs shall be provided with Stoneman "Stormtite" seamless lead flashing (or approved equal).

3.10 DELIVERY AND STORAGE OF EQUIPMENT

1. This Contractor shall store, take deliveries and install all equipment in accordance with manufacturers requirements. (see general conditions)

3.11 STERILIZATION

1. After final testing for leaks, all new potable water lines shall be thoroughly flushed, by plumbing contractor, to remove foreign material. Before placing the system in service, Contractor shall engage a qualified service organization to sterilize the new water lines in accordance with the following procedure:

   A. Through a ¾" hose connection in the main entering the building, pump in sufficient sodium hypochlorite to produce a free available chlorine residual of not less than 100 ppm.

   B. Proceed upstream from the point of chlorine application opening all faucets and taps until chlorine is detected. Close faucets and taps when chlorine is evident.

   C. When chlorinated water has been brought to every faucet and tap with a minimum concentration of 100 ppm chlorine, retain this water in the system for at least two (2) hours.

   D. At the end of the retention period, no less than 10 ppm of chlorine shall be present at the extreme end of the system.

   E. Proceed to open all faucets and taps and thoroughly flush all new lines until the chlorine residual in the water is less than 1.0 ppm.

   F. Obtain representative water samples from the system for analysis by a recognized Bacteriological Laboratory.

G. If all samples tested for coliform organisms are negative, a letter and laboratory reports shall be submitted by the service organization to the Contractor, certifying successful completion of the sterilization.

H. If any samples tested indicate the presence of coliform organisms, the entire sterilization procedure shall be repeated.

3.12 PLENUM AREAS

1. Any duct plenum area, ceiling or room plenum shall not contain any combustible material, and all insulation, wiring and/or piping shall be suitable and approved by local authorities for plenum installation.

3.13 SCHEDULE OF WORK

1. The exact times and dates and schedules that the schools will be available for contractor to do work, shall be as indicated in General Conditions.

3.14 CONTINUITY OF SERVICES - EXISTING BUILDINGS

1. The work under the Contract shall not interrupt services to the existing buildings, except if all the following conditions are met:

   A. Building personnel are notified in advance and approve date and time in writing.

   B. Interruption of service does not exceed one (1) hour unless otherwise approved.

   C. Interruption of service does not occur during normal working hours.

2. No "extra" compensation will be permitted due to the overtime hours implicit in the requirements of this section.

3. Where interruptions will affect life safety and/or other critical systems, proper precautions shall be taken to maintain level of protection or system operation acceptable to Owner and/or authorities having jurisdiction.

4. This Contractor is cautioned that the existing building is to remain occupied during construction and that all services to the building are to be maintained. There shall be no interruption of services and, if absolutely necessary, at least seven (7) days prior notice is required.

5. Any interruption of life safety systems (fire alarm sprinkler) the fire department and alarm company shall be notified, and proper precautions taken.

6. There shall be no obstructing the exit ways from existing building.

7. All interruptions of service shall be done at times which cause least disruption of service.

3.15 RELOCATION OF EXISTING EQUIPMENT

1. This Contractor shall be responsible for removal, storage, relocation and installation of all existing equipment shown or scheduled to be relocated. This Contractor will be responsible for capping of all existing services presently feeding existing equipment which is to be relocated and shall patch all surfaces to match existing as required.

2. All patching work shall be done by workmen skilled in this craft and shall in no way affect the stability, finish or operation of the casework or other equipment.

3. All equipment requiring plumbing connections shall be the responsibility of this Contractor. A composite crew shall be used using mechanics skilled in their field.

3.16 PROTECTION OF SERVICES DURING CONSTRUCTION AND DEMOLITION

1. This Contractor shall repair, replace, and maintain in service any utilities, facilities or services (in existing areas where demolition is to occur) which are damaged, broken, or otherwise rendered inoperative during the course of demolition.

2. This Contractor shall effectually protect, at his own expense, such of his work, materials or equipment that may be subject to damage during the construction period.

3. All openings must be securely covered, or otherwise protected.

4. This Contractor shall be held responsible for all damage so done until his work is fully done and finally accepted.

5. It shall be the responsibility of this Contractor to protect existing and new motors, pumps, electrical equipment, plumbing fixtures and all phases of construction.

3.17 EQUIPMENT LIST

1. Refer to General Conditions. Exclusion of items on list does not relieve Contractor of the responsibility from providing equipment as specified, required to complete work as shown on drawings that is to be provided by this Contractor.

	MANUFACTURER			
EQUIPMENT	NUMBER 1	NUMBER 2	NUMBER 3	NUMBER 4
Plumbing Fixtures	American Standard	Kohler		Or approved equal
Sinks	Elkay	Moen	American Standard	Or approved equal
Valves	Mueller	Stokham	Nibco	Or approved equal
Insulation	Owens/Corning	Johns Manville		Or approved equal
Carriers	Josam	J.R. Smith	Zurn	Or approved equal
Plumbing Specialties	Josam	J.R. Smith	Zurn	Or approved equal
Floor Drains	Josam	J.R. Smith	Zurn	Or approved equal
Lavatory Fittings	Symmons	American Standard	Kohler	Or approved equal
Sump Pump	Berkly	Zoeller		Or approved equal

3.18 UNIT PRICES (See General Conditions)

1. See "General Conditions".

3.19 ALTERNATE BID

1. See "General Conditions". Refer to drawings and specifications for extent of work.

3.20 REPAIR AND PATCHING OF EXISTING SURFACES

1 Unless otherwise shown to be done by general contractor, this Contractor shall cut and patch walls, floors, ceilings, roof surfaces and all existing construction for the removal of existing equipment, fixture, piping, controls and other construction for the completion of work under this Contract. All equipment, piping, ductwork, furniture and all construction or materials that are disturbed during construction shall be stored and protected from damage until replaced.

2. Cutting shall be done only after shop drawings have been prepared and with the Architect's approval. This Contractor shall exercise proper care and shall not endanger the structure by indiscriminate cutting and shall be responsible for and shall protect all existing construction to remain from damage and shall provide and maintain all necessary temporary protective materials, coverings and barricades.

3. This Contractor may hire the other prime contractors to perform this work or hire qualified, independent contractors. This Contractor shall be familiar with and assume all responsibility for any conflicts with union policy and provide supervision in such a manner as not to impede the progress of other trades and be responsible for the adequacy and accuracy of same.

4. Wherever previously unfinished areas are exposed by the removal of existing piping or related equipment, these areas shall receive new finishes to blend into the adjoining work.

5. Wherever existing chases must be enlarged to encase new work, they shall be enlarged to match the existing.

6. Wherever fire rated material must be patched, it shall be patched in a manner not to affect its fire rating.

7. All patching work must be done by skilled mechanics in a manner to minimize the patch effect. Wherever new painting is required, it shall be done with at least two coats over new materials.

8. The painting must not only cover the area of the actual patch, but also to the nearest natural break of the newly painted surface.

9. Wherever the surrounding surface to be painted is in poor condition, all loose paint shall be removed before new paint is applied.

10. Patching of existing floor must be done in a manner to assure smooth undersurface and all joints must line up with existing.

11. Wherever new vinyl or rubber bases are to be supplied, they shall match adjoining bases in height and color.

12. Whenever existing ceilings are disturbed, they shall be replaced with new ceiling tiles or patched to match existing and all services, lights, fixtures, etc. supported temporarily and permanently reinstalled.

13. In all spaces in which the contractor is working, he shall protect all existing surfaces.

14. This Contractor shall remove and replace all ceilings required for his work with the exception of ceilings shown to be removed by general contractor on architectural plans.

3.21 REMOVAL

1. This Contractor shall remove existing systems as indicated on drawings.

2. All equipment, cabinets, ductwork, pipe controls, all pipe insulation (except any asbestos insulation), hangers, electric wiring and all construction and appurtenances shall be removed, to complete all work under this contract.

3. Equipment identified by Owner, prior to removal, that is to be retained by the Owner, which is not to be re-installed, shall remain the property of the Owner and shall be removed undamaged and stored in a suitable location where directed by the Architect. This Contractor shall then load, transport and unload equipment from building to site designated by Owner within a 20-mile radius of project.

4. Removed piping, equipment, fixtures, pipe insulation and all debris shall be removed from the building and site in accordance with General Conditions.

5. All debris in areas occupied by the building personnel during periods of building operation shall be removed daily.

6. This Contractor shall patch all wall, floors and ceilings and roof surfaces to match existing adjacent surfaces where obsolete equipment, piping, controls and wiring are removed.

7. Work shown on drawings may not indicate all equipment, pipe, etc., nor exact routes, sizes, locations, etc. The drawings are <u>not</u> to be used for estimating detailed take-off for amount of work required, drawings are for reference only. This Contractor shall visit site to determine extent of work and all conditions.

3.22 BUILDING ALTERATION WORK

1. This Contractor shall furnish all labor, equipment and materials required to complete alteration work in the building. Remove existing construction and replace, to remove existing equipment and/or install new equipment in conjunction with the work.

2. Cut, patch and paint walls, floors, ceilings, roof surfaces and all construction for the installation of equipment, piping and controls.

3. Cut and patch exterior walls for the installation of air intake and exhaust. Finish to match existing adjacent surfaces.

4. Where existing electrical HVAC or plumbing work, due to removal of existing and/or installation of new equipment, is required to be removed. This contractor shall disconnect existing equipment, cap services in a safe manner, remove equipment, store in a location to prevent damage, replace equipment and patch construction to match existing conditions and reconnect equipment to existing services.

5. This Contractor shall either retain qualified independent contractors or utilize the other on-site contractors. This Contractor shall assume all requirements for any conflicts with union policy and be responsible for same. This Contractor shall furnish necessary shop drawings and supervision, in such a manner as not to impede the progress of other trades and be responsible for the adequacy and accuracy of same.

3.23 CONSTRUCTION SEQUENCING

1. Refer to General Conditions for the overall contract staging. However, specific items for plumbing contractor should be noted. The following are suggested methods of staging of construction. Alternate methods to achieve the intent of these specifications will be allowed; however, they must be coordinated with other trades and submitted for review and approval.

2. The sequence of construction shall be as indicated in the General Conditions of the specifications.

3. Where work is shown on plumbing plans where it is outside the phase areas indicated or specified in the General Conditions, this work shall be done at any time. All work shall be done so not to interfere with normal school operations. Where work is done outside normal school occupied areas (boiler room, roof area), this work may proceed at contractor's option. All work, regardless of the location of work, type of work, or extent of work, shall be done with the approval of the School District.

4. Where work in a particular phase requires work to be done outside that phases' construction boundaries, this Contractor shall locate all new duct, pipe, and equipment to allow for new construction and/or to integrate with existing building construction.

5. All new ductwork and piping shall be installed and coordinated with proposed new work.

6. All work required to be modified due to non-compliance with this section, General Conditions or Construction Sequencing, shall be removed, replaced and/or modified at no additional cost to Owner.

7. Where pipe is shown to serve future phases, provide capped outlet suitable for connection when phase is completed. Provide valves for isolation and draining lines without affecting the work installed in earlier phase.

END OF SECTION
15015.6290

SECTION 15115 - BASIC MATERIALS AND METHODS

PART 1 GENERAL

1.01 MATERIALS AND EQUIPMENT

1. All material and equipment used for this contract shall be unused and of the latest model or design available. Equipment shall be installed in strict accordance with manufacturers' recommendations and details.

2. Materials not specifically described but indicated or incidentally required shall be acceptable to the Architect and/or Engineer. Submit shop drawings. Materials shall be delivered, stored and handled so as to preclude injury by weather, dirt or abrasion.

3. This Contractor shall use only specifically assigned areas for storage of materials and construction operation, unless other areas are authorized by the Owner. Such areas will be identified after the award of Contract by Owner. Comply with local municipal regulation regarding use of and parking on public streets.

4. This Contractor shall repair streets, drives, curbs, sidewalks and any existing surface where disturbed by construction operations and leave them in as good condition after completion of the work as before operations started.

1.02 PROTECTION

1. No pipe shall be left open any longer than is required to affix the next piece. If pipe ends are to be left for a protracted period they shall be closed with approved plugs or caps.

2. All equipment shall be covered to protect it from damage; all damage is the responsibility of this Contractor.

3. Any pipe, equipment or construction in existing building shall be done in such a manner to prevent injury to building personnel. Particular care must be taken for any work which will be done during building's normal operation.

1.03 IDENTIFICATION OF PIPING

1. Use color scheme for painting listed in "Scheme for Identification of Piping System", ANSI/ASME A13.1 and Rust-Oleum Corporation Form # 117 Or approved equal. Paint identifying bank of color near each valve and fitting, on both sides of pipes passing through wall, and on long pipe runs approximately every 30' (closer when directed), throughout building. Exposed piping in mechanical rooms and all other areas including insulation, hangers, supports, valves and all appurtenances shall be painted color selected.

Gas Pipe	Yellow (Note: Paint all exposed and rooftop gas pipe.)
Domestic Water	Light Blue
Domestic Hot Water	Orange
Sanitary	Dark Blue
Vent	Blue

2. Stencil on pipe, near each valve, name of pipe contents in abbreviated form, size of pipe, and arrow indicating direction of flow. Place legend in such location that it can be read from floor. Size of stencil letters shall vary with the size of pipe.

3. Seaton "SETMARK" pipe markers or approved equal are acceptable.

1.04 TESTING

1. At the completion of all work, and before any covering is applied, all piping except drainage shall be tested hydrostatically at a pressure equal to 150% of the working pressure or to material test pressure, if lower. All piping concealed in any manner shall be tested before being concealed. Maximum drop in pressure permissible shall be two (2) psi in 24 hours.

2. The drainage system shall have openings plugged and be filled with water to the level of the main gutter or top of vent pipes and allowed to stand at least thirty minutes. Each stack may be tested separately.

3. Testing shall be in accordance with ANSI B31.1 in all test gauges, traps and all other apparatus which may be damaged by the test pressure shall be removed or valved off from the system before tests are made.

4. In existing building all required tests on new and/or existing systems shall only be done after normal working hours. All tests done in building shall be done in such a manner as to avoid injury to building personnel and damage to existing and/or new construction. Protect all new and existing construction from damage which may occur as a result of the test or failure of test material.

5. This Contractor shall be responsible for all costs associated with damage to materials or liability due to injury to personnel, as a result of tests or failure of tests.

1.05 PRESSURE RATINGS

1. All equipment and materials shall have a working pressure as determined by A.S.M.E. (or similar body), of not less than 125 psi.

1.06 SLEEVES

1. All pipes passing through construction shall be fitted with flush sleeves of sufficient diameter to pass the insulation. Sleeves shall be 20 USG galvanized iron, except in masonry, where steel pipe sleeves shall be used. Sleeves in waterproof construction shall be steel pipe, waterproofed with modular mechanical synthetic rubber seals equal to "Link Seals" (Thunderline, or approved equal). In floors they shall extend one inch above the floor.

2. In fire divisions, sleeves shall be constructed of fire-retardant material and shall be installed to maintain the fire integrity of the fire division.

3. All materials and construction methods shall be installed in accordance with the manufacturer recommendations and the requirements of the IBC Code or any other applicable codes.

PART 2 PRODUCTS

2.01 PIPE

1. Steel pipe shall be Schedule 40, electric welded, ASTM-A53, Grade A, plain or galvanized as specified under applicable system.

2. Copper tubing shall be hard temper "Type L" except that all piping underground shall be "Type K", conforming to ASTM-B-88.

3. Cast iron soil pipe shall be extra heavy Bell and Spigot spun type conforming to ASTM-A-74. Standard or medium weights may be used, if permissible under local code.

4. PVC Pipe

   A. Polyvinyl chloride pipe (PVC) shall be Schedule 40 conforming to ASTM-D-2241.

   B. Sound rating exposed PVC pipe in finished areas shall have sound rating equal to or less than the sound radiated from cast iron pipe (25-30 DB).

   C. Where sound ratings are greater, contractor shall install insulation wrap to reduce the radiated sound to less than the sound radiated for cast iron pipe.

   D. Contractor to install PVC pipe with supports at intervals required by the applicable plumbing code.

   E. Provide fire listed fire stop devices or collars in accordance with ASTM E814 on both sides of pipe penetrations of fire rated assembly temperature.

   F. PVC pipe shall not be used where temperatures exceed 140°F.

   G. All underground pipe to be installed in accordance with ASTM D2321.

2.02 PIPE FITTINGS

1. All welded fittings shall be of the same thickness and material as the pipe meeting ASTM-A234. Branch connections shall be made with Weldolets or welding fittings.

2. All flanges shall conform to A.S.A. B-16 using gaskets suitable for the service.

3. Cast iron drainage fittings shall be standard weight galvanized cast iron, banded and recessed.

4. Malleable iron fittings shall be 150 psi wsp conforming to ASTM-A-338.

5. Fittings for copper tubing shall be wrought copper of the solder Type conforming to A.S.A. B16.22.

6. Extra heavy cast iron soil pipe fittings shall conform to ASTM-A-74, all changes in direction being made with "Y" branches or 1/8" (or less) bends.

7. A.S.A. A21.10 or AWWA Class 250 cast iron fittings shall be used on cast iron water pipe and A.S.A.11 Class 250 mechanical joint pipe. All piping shall be properly blocked. Use lined fittings in lined pipe.

8. Fittings for polyvinyl chloride (PVC) shall be socket fittings or solvent welded.

2.03 BALL, GLOBE AND CHECK VALVES

1. All valves 2" or smaller shall be ball valves; bronze solder end valves in copper tubing and screwed end in other lines. Globe and swing check valves shall be of similar construction with renewable composition disc.

2. All valves 2½" or larger shall be 125 psi WSP, 200 psi WOG bronze mounted, silicon bronze stem, outside screw and yoke, blotted bonnet and follower gland, iron body, flanged end, wedge gate valves. Valves shall be provided with back seat to permit packing under line pressure. Globe and Swing check valves shall be of similar construction with renewable, regrinding, bronze disc and seat.

2.04 PLUG AND BALL VALVES

1. Plug and ball valves shall be 150 psi WOG with full port. Valves to be lever operated, screwed or solder end in sizes up to 2". Valves used for balancing shall have infinite throttling handle and adjustable stops. All valves bubble tight shut-off.

2. Plug and ball valves shall be 150 psi WOG with full port. Valves to be lever operated, screwed or solder end in sizes up to 2", flanged end in 2½" to 6" size.

2.05 UNIONS

1. Unions shall be installed where needed to facilitate the removal of equipment.

2. Unions 2" and smaller in copper tubing shall be all brass, ground joint, solder end. In other lines, screw end, malleable iron, 125 psi WSP, 300 psi WOG of the ground type.

3. Unions 2½" and larger in copper tubing shall flanged pattern, all brass, solder end. In other lines, 125 psi WPS-175 psi WOG, cast iron flanged pattern, black or galvanized to match piping.

2.06 ESCUTCHEON PLATES

1. Where any pipe passes into a finished space, there shall be provided a solid brass, chrome plated, escutcheon plate held to the pipe mechanically or fastened to the building construction.

2.07 ANCHORS

1. Anchors of approved design shall be provided where shown or required for the proper control of the stress due to expansion. Anchors shall be heavy metal sections securely fastened to the building construction.

2.08 DRIP PANS

1. Provide drip pans for all pipes and equipment carrying liquid or, liquid vapors where pipes pass over areas or electrical equipment. Drip pans shall be constructed of galvanized metal. Provide drain line to closest sanitary line.

2.09 ACCESS PANELS

1. Furnish and install access panels not smaller than 18"x18", for access to all concealed valves, and equipment, accessories, etc.

2. Access panels shall be all steel construction with a No. 16-gauge wall or ceiling frame and a 16-gauge wall or ceiling frame and a 14-gauge panel door with not less than 1/8" insulation secured to inside of door.

3. Doors shall have concealed hinges and cylinder lock except doors for wall panels may be secured with suitable clips and countersunk screws.

4. Access panels shall be flush with finished wall or ceiling and shall be painted to match adjacent surfaces. Access panels behind finished surfaces shall have color coded marking on finished surface to indicate location of doors and type of equipment.

5. Access panels in fire rated construction shall be fire rated.

2.10 ANCHOR BOLTS

1. Contractor shall furnish and install anchor bolts as required for the equipment. Anchor bolts shall be DECO's standard anchor with floating nut, adjustable ½" in any direction. Grout all bases.

2.11 HANGERS

1. All piping shall be supported by hangers, concrete inserts, and insulation saddles conforming to MSS-SP-58.

2. Hangers for cast iron pipe shall be spaced at least one per length, but not more than 7'apart. For steel and copper pipe, pipe shall be spaced not over 8' apart.

3. Vertical runs of pipe shall be supported by riser clamps except that pipe 1¼" and smaller may be braced by galvanized malleable iron fasteners.

4. Hangers for copper tubing shall be copper plated, and completely encircle the tubing. A hanger shall be placed no further than 24" from each change in direction of piping.

5. Hangers shall not be connected to or supported from other pipe, conduit or equipment, but shall be supported from building structure.

2.12 STRAINERS

1. Strainers to be self-cleaning ("Y" type), cast iron body installed ahead of all control valves and pumps; screens to be Monel or stainless steel with proper perforations for the service, ends to be screwed to 2" size, flanged for sizes 2½" and larger.

2. Provide ceramic magnets in each strainer used in systems containing iron.

PART 3 EXECUTION

3.01 EXCAVAION AND BACKFILL

1. This Contractor shall do all excavating and backfilling necessary and repair finished surfaces that are disturbed. Contractor shall remove or distribute all earth remaining as directed, and/or provide required backfill.

2. Excavate all substances encountered to the depths and sections shown on drawings. Excavation for pipes, manholes, catch basins, drain inlets, and other accessories shall have 12" clearance on all sides.

3. Areas adjacent to any excavation shall be graded to prevent water running in. Excavation shall not be carried below the required level, and if so carried; shall be backfilled with gravel or sand and tap to proper compaction.

4. This Contractor shall do bracing, sheathing, shoring, and pumping necessary for proper completion of the work and for protection of excavations or as required for safety. Temporary bridges or crossings shall be built where required to maintain traffic.

5. After proper inspection and tests all excavation shall be backfilled with approved material, free from large stones, clods or frozen earth, wood and other objectionable material. Contractor shall haul away excess material or provide additional fill as required.

6. Backfill for pipes shall be placed evenly and carefully around and over the pipe in six-inch minimum layers. Each layer shall be thoroughly and carefully rammed by hand until one-foot cover exists over the pipe. The remainder of the backfill shall then be placed, moistened and compacted to a density equal to that of adjacent original materials using mechanical tamping machines.

7. Backfill for sewage ejector and other structures shall be placed symmetrically on all sides in one-foot maximum layers and shall be compacted with mechanical or hand tampers to density equal to 90% of laboratory density in accordance with ASTM-D698 test.

8. Where trenches pass under footings backfill with tamped concrete, 2,500 psi minimum, around steel pipe sleeve.

3.02 INSTALLATION OF PIPING

1. All fittings, offsets, etc., may not be shown. Contractor shall determine their necessity by investigating conditions at the site.

2. Contractor shall use shop drawings for exact locations.

3. All piping above ground shall be run parallel with the lines of the building in the most direct manner, concealed in furred spaces where possible.

4. Pipes shall be cut accurately and placed without springing or forcing all burrs removed.

5. All water piping inside the building shall be properly graded to drain ½", hose outlet, angle drain valves.

6. All changes in size of piping shall be made by reducing fittings; no bushing will be permitted unless approved.

7. This Contractor shall determine, with approval, where expansion joints, loops or anchors will be required due to space restrictions prohibiting proper run-out flexibility.

8. Valves, air vents, balancing cocks, etc., shall be placed in accessible positions, and flush metal access doors, (12"x12" minimum size), with necessary lintels, etc., provided where they are concealed.

9. All piping shall be located to prevent freezing. Where pipe is located in areas subject to freezing, provide freeze protection and insulation. Refer to Specification Section 15185.

3.03 CLEANING OF GRAVITY SYSTEMS – INITIAL CLEANING

1. Prior to start of construction and/or renovation work, this Contractor shall provide a hydro-jet cleaning and a video inspection. All existing sanitary for new toilet rooms connects to existing main in corridor.

2. The cleaning shall be all existing sanitary pipe to 5' +/- outside of building.

3. This Contractor is responsible for all work and all cost of work. This Contractor shall utilize a certified independent sub-contractor using the latest technology to perform the hydro-jet cleaning and video inspection.

4. Work shall be done so that any debris and blockages encountered shall be removed. Take proper precautions (i.e. screening, etc.) to prevent the debris and material from entering the municipal sewer system.

5. Any blockages encountered which cannot be removed by hydro-jet cleaning shall be the responsibility of this Contractor to remove.

6. Any leaks encountered shall be reported to Owner.

7. At the completion, provide video with a written test report to Owner.

3.04 CLEANING OF GRAVITY SYSTEMS – FINAL CLEANING

1. At completion of project, prior to owner occupancy, this Contractor shall provide a hydro-jet cleaning and a video inspection of the newly installed gravity sanitary systems. The scope of work is all existing and new gravity systems installed in building and outside building as indicated in Section 3.03 for initial cleaning.

2. This Contractor is responsible for all work and all cost of work. This contractor shall utilize a certified independent sub-contractor using the latest technology to perform the hydro-jet cleaning and video inspection.

3. Work shall be done so that any debris and blockages encountered shall be removed. Take proper cautions (i.e., screening, etc.) to prevent the debris and material from entering the municipal sewer system.

4. Any blockages due to new construction work which cannot be removed by this hydro-jet cleaning shall be the responsibility of this Contractor to remove. Remove and replace all existing construction, pipe and equipment necessary to access pipe system to clean pipes and clean system to the satisfaction of the owner, engineer and local authorities having jurisdiction.

5. Any leaks due to new construction and/or renovation work shall be the responsibility of this Contractor to repair to the satisfaction of the owner, engineer and local authorities having jurisdiction.

6. At the completion provide video with a written test report to Owner.

3.05 DRAINAGE PIPING

1. All vent piping may not be shown. This Contractor shall install all vents that may be required by local authorities.

2. All piping shall be so installed that any point in the system can be cleaned by a standard-length snake.

3. It is intended that no horizontal pipe be built into masonry.

4. Vent piping shall be extended full size (minimum 3") above the roof. Offset vents at roof to clear structure.

5. Provide cleanouts at all traps, the bases of all stacks and rain conductors, changes of direction greater than 45 degrees and other points shown on drawings or required by authorities having jurisdiction, on 4" dia. pipe or less, maximum 75' and 5" dia. pipe and larger; 100' maximum. Cleanouts in buried piping shall be brought up flush to finished floors, outside to 18" below finished grade. Cleanout shall be full size for pipe up to 4", and 4" in larger pipes.

6. Exterior cleanouts shall be cast brass raised plug type.

7. Interior cleanouts shall be similar with polished nickel bronze access cover for flush mounting.

8. In concrete floors cleanouts shall be cast brass countersunk plug type with nickel bronze adjustable head and heavy duty scoriated cover.
9. Provide two-way cleanouts at all sanitary laterals at exterior of building.

10. Coordinate locations of all cleanouts with other trades. Relocate or add cleanouts when interferences occur at no additional cost to Owner.

11. Where pipe is installed in previously compacted fill, this Contractor shall be responsible, at no additional cost to Owner, to backfill and compact soil to within tolerances provided by Architect.

3.06 JOINING PIPE

1. Steel piping shall be of welded or flanged construction in sizes 2½" and larger; screwed or welded construction in sizes 2"and smaller. All screwed fittings to be cast iron unless otherwise specified. All threads shall be conformity with A.S.A. B-21.

2. All screwed pipe joints shall be made with Teflon Dry Thread Sealer (3M-#48) or approved equal applied to male threads only.

3. Soldered joints shall be made with non-acid flux and lead-free solder (ASTM 32-60AT). Fluxes shall be used sparingly, and excess wiped from copper.

3.07 JOINING DISSIMILAR METALS

1. Where copper is jointed to steel, joints shall be made by means of brass or bronze adapter in a cast iron fitting or by means of an electrochemically insulated union.

2. Hangers supporting copper tubing shall be copper, or copperized. Copper tubing lines shall not be, even temporarily, supported or secured to ferrous metals.

3.08 FOUNDATIONS

1. Foundations shall be provided by this contractor for all equipment mounted on concrete floors and shall be of concrete construction not less than 6" high unless otherwise shown.

2. Details of all foundations shall be submitted for approval.

3. Foundations or footings for structural steel supports shall be carried to a point not less than 12 inches below the underside of the floor slab, except where rock is encountered at less depth, then foundation may set on the rock.

4. All foundations shall be built to templates and reinforced as required by the load to be imposed upon them.

3.09 STRUCTURAL STEEL

1. This Contractor shall furnish and install all structural steel, supports, braces, hangers, etc., required for his Contract unless shown as being supplied by others.

2. Structural steel shall conform to "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings", of the American Institute of Steel Construction, and where applicable, "Code for Welding Building Construction", of the American Welding Society.

3.10 ERECTION AND RIGGING

1. This Contractor shall do all rigging, hoisting and setting-in place of all equipment furnished by him or as shown on drawings or as specified herein.

3.11 NATURAL GAS

1. The gas piping system shall be installed, and final connections made as part of the section titled, "GAS PIPING".

2. All gas-fired equipment shall have such equipment complete and ready to operate so that only the final connection of gas piping will be required.

3.12 CONNECTIONS TO OWNER FURNISHED EQUIPMENT

1. The Owner furnished equipment consists of various types of HVAC equipment that shall be installed by contractor.

2. The specified type, quantity and details are referenced in specifications and drawings.

3. The contractor shall be responsible for providing all pipe and appurtenances that will allow for equipment to be operated. The equipment shall be permanently installed in the locations and of sizes shown. The exact locations shall be coordinated with the School District.

4. The service connections shall be provided with mains to allow for equipment disassembly and assembly for educational purposes.

END OF SECTION
15115.6290

SECTION 15185 - INSULATION

PART 1 GENERAL

1.01 SCOPE

1. All surfaces throughout the work shall be insulated with fiberglass insulation as indicated in applicable section.

2. Removal, repair and/or replacement of existing insulation on all existing pipe and equipment due to new work or connection of new work to existing.

PART 2 PRODUCTS

2.01 PIPE INSULATION

1. All piping throughout the work shall be insulated with fiberglass pipe insulation in thickness, indicated in 3.04, of high density and with jacket indicated in the applicable section. (Except that outside thickness shall be doubled.) Vapor barrier jackets shall have self-sealing lap joint, and joints between sections shall be covered with a 4" wide strip to self-sealing vapor barrier materials.

2. Aluminum bands shall be applied, two to a section on all indoor insulation.

3. On outdoor installations, double insulation thickness and provide metal jacket banded or with sheet metal screws.

4. All pipe exposed in finished areas shall be painted color selected. Where insulation is subject to damage or is located below 7'- 0" AFF, insulation shall have stainless steel jacket with no exposed joints or seams.

5. All insulation shall be "plenum rated".

PART 3 EXECUTION

3.01 INSTALLATION OF PIPE INSULATION

1. All pipe insulation shall be applied over dry, clean surface with joints tightly butted and jacket firmly and securely attached and smoothed. Insulation shall be continuous through wall, floor or ceiling openings and sleeves.

2. All valve bodies and fittings shall be insulated with preformed fittings of thickness equivalent to adjacent insulation and jacketed with same material. At Contractor's option, except in plenums, outdoors and where not permitted by code; provide precut fiberglass insulation blanket of same insulation thickness as adjacent insulation with a preformed snap on type molded PVC jacket, cover edges with vapor barrier adhesive or vapor barrier tape.

3. Provide metal shields under all hangers or pipe supports on outside of insulation; on roller supports provide pipe shoe cavity with insulation. Provide insert between support shield and piping on piping 1 1/2" dia. and larger. Insulation inserts shall be heavy duty insulation material length 12" up to 6" dia. pipe 16" long on 8" & 10" pipe, and 22" long on 12" pipe and larger. **HANGERS SHALL NOT PENETRATE PIPE INSULATION.**

4. On outdoor insulation, double insulation thickness, provide metal jacket; and prefabricated, removable and replaceable metal jacket at fitting and valves.

5. Locate insulation and cover seams in least visible locations, neatly finish insulation at supports, protrusions and interruptions.

3.02 EQUIPMENT INSULATION

1. All equipment containing fluids whose piping is specified to be insulated or whose surface temperatures will be low enough to cause condensation (60° F.), or high enough to burn persons touching same (110°F.), shall be insulated with a minimum of 1½" thick fiberglass block firmly butted and wired in place, and covered with ½" thick coat of insulating cement troweled over one inch galvanized hexagonal wire mesh and finished cement troweled smooth. Metal corners beads shall be applied to protect corners.

3.03 INSULATION THICKNESS

1. Minimum pipe insulation thickness shall be in accordance with the ASHRAE 90.1-2007, local requirements, or the following table:

PIPING SYSTEM CLASSIFICATION	FLUID TEMP. RANGE,F.	INSULATION THICKNESS IN INCHES FOR PIPE SIZES		
		1"and LESS	1-1/4 to 2	2-1/4 to 4 and over
Domestic Hot Water Supply and Return	120-200	1"	1"	1"
Domestic Cold Water	40-60	1"	1"	1"
Horizontal Storm Lines		1"	1"	1"

2. Where piping runs outdoors, double insulation thickness.

3. This Contractor shall provide heat tape (electric) to prevent freezing of outdoor piping and all other piping subject to freezing. Electric heat tape to be Chromalox Type M1 cable or approved equal, furnished with all controls, power wiring and appurtenances. Size and capacity per manufacturers' requirements.

END OF SECTION
15185.6290

SECTION 15410 - WATER SUPPLY SYSTEMS (INTERIOR)

PART 1 GENERAL

1.01 SCOPE

1. The work under this heading shall include furnishing and installation of:

   A. All domestic water piping, insulation, plumbing material and specialties required for the proper functioning of the work. Connections to all equipment requiring domestic water connections whether furnished under this section or not. Sloped piping and valves to permit drainage of entire system.

   B. Connection to, modifications, extension, replacement, and/or removal of existing system and equipment for new work.

PART 2 PRODUCTS

2.01 PIPING MATERIAL

1. Water Services - Copper Tubing Type "L", Type "K" underground. All exposed piping under and adjacent to fixtures shall be chrome plated brass pipe. All pipe shall have lead-free solder.

2.02 CONDENSATE NEUTRALIZING KIT

1. Provide condensate neutralizing tubes for each hot water heaters, boilers and/or furnaces, condensate drain and all flue pipe condensate drains.

2. The condensate tubes shall be designed to raise the PH level 10-30 times more toward the neutral point of the PH being discharged by the hot water heating.

3. The neutralizer tube or tubes shall be Model JM, sized pre-manufacturer and as manufactured by JMM Boiler Works or approved equal.

4. Connect all vent condensate drains with P- Traps and unions before the neutralizing tubes.

5. All piping from heater and/or flue. Tube shall be PVC and supplied/installed by this Contractor. All PVC joints shall be glued in place and all barbed fittings shall be secured with tie wraps.

6. The condensate drains shall not be combined into one neutralizer. All piping shall be per manufacturer's piping diagrams and directions. All neutralizing tubes shall be secured to the floor or wall, so as not to be exposed to damage or within a normal walkway.

7. The Contractor shall inform the Owner of any maintenance or scheduled recharge of the tube's limestone aggregate as described in the manufacturers' Operation and Installation manual.

8. Maintenance of tubes shall be for the 2-year maintenance agreement per General Conditions.

2.03 HOT WATER RECIRCULATION PUMP (OWNER FURNISHED)

1. Hot water recirculating pumps shall be centrifugal pumps especially designed for the service.

2.04 STORAGE WATER HEATER (OWNER FURNISHED)

1. Install domestic hot water heaters as shown on plans. Heaters shall have pressure temperature relief valved piped to receptor. Insulate in accordance with ASHRAE-90 requirements.

2.05 STORAGE WATER HEATER EXPANSION TANK

1. Provide expansion tank on domestic hot water heaters where required and where heaters are installed with check valve on cold water and/or on installations with backflow preventers on main water service.

2. Expansion tank to be installed on cold water inlet to storage heater.

3. Tank shall be equipped with air inlet and water drain off and shall be diaphragm type tanks (Amtrol Therm-X-Trol Model ST or approved equal), where required provide ASME tanks.

4. Minimum tank volume shall either be as required by Amtrol Form ST-8-89 or approved equal or .11 gallons expansion tank per gallon of storage tank capacity, whichever is greater. Volumes based on 140°F. water temperature, for higher temperatures adjust volumes accordingly.

PART 3 EXECUTION

3.01 INSULATION

1. See Section titled "INSULATION".

2. Domestic Cold Water, Hot Water and Hot Water Recirculating Line - Fiberglass with all service jacket.

3.02 STERILIZATION

1. After the tests have been completed, and before the system is put into operation, the entire water system shall be sterilized as required in Section 15015.

3.03 BALANCE COCKS AND RECIRCULATION SYSTEM

1. Balancing plug valves shall be installed in each branch of the recirculating system. Install thermometer in each branch of recirculating system near plug valve to facilitate balancing.

3.04 EXPOSED LINES

1. All domestic water pipe in finished areas shall be concealed in drywall and/or concrete block walls. Where installed in concrete block walls, pipe to be installed within cores and done without cutting block. Where it is not possible to locate in wall without removing block, this Contractor shall coordinate with general contractor location and sizes required. This Contractor shall cut and repair block. Finishing of block shall be suitable for painting.

2. Where is determined by construction manager and/or architects that pipe must be exposed in finished area, it shall be enclosed in sheet metal chase constructed per architectural details by this Contractor.

3. No pipe shall be allowed in finished areas, except where specifically indicated (backflow preventers, etc.) Pipe shall be insulated and protected per Specification Section 15185. Exposed pipe runouts to fixtures shall be chrome plated.

END OF SECTION
15410.6290

SECTION 15420 - SOIL AND WASTE SYSTEM

PART 1 GENERAL

1.01 SCOPE

1. The work under this heading shall include the furnishing and installation of:

   A. All soil, waste and vent piping, including connections to sewers. All materials and specialties required for the proper functioning of the work. Connections to all equipment requiring soil, waste or vent connections whether furnished by this Contractor or not.

   B. Connection to, modification, extension, replacement, and/or removal of existing system and equipment required for new work.

PART 2 PRODUCTS

2.01 PIPING MATERIALS

1. Drainage Systems - Cast iron soil pipe. Galvanized steel, copper tube, etc., may be acceptable if locally approved for underground and above sanitary.

2. All sanitary pipe below floor shall be Schedule 40 PVC.

3. All vent pipe above grade shall be cast iron.

2.02 JOINTS

1. Neoprene gasket joints may be acceptable if locally approved.

2. "No Hub" pipe, fitting and joint material may be acceptable if locally approved.

PART 3 EXECUTION

3.01 MINIMUM COVER FOR EXTERIOR LINES

1. Soil Lines – 3'-0"

3.02 PIPE INSTALLATION

1. Provide minimum slope of 1/8" per foot or as required by local code. Install cleanouts at lower ends of stacks, at each change of direction, where indicated, or required by local code. Support cast iron pipe risers at base of stack and at hubs.

2. Offset vent lines through roof to obtain minimum visibility from front of the building. Extend vents a minimum of 2' above roof line.

3. Flash vents passing through roof with sheet lead (6 lbs./Sq.Ft.). Extend lead vertically up pipe and turn down into bore 2" or terminate in special flashing collar. See Section titled "General Requirements - Flashings".

END OF SECTION-15420.6290

SECTION 15440 - GAS PIPING SYSTEM

PART 1 GENERAL

1.01 SCOPE

1. The work under this heading shall include the furnishing and installation of:

   A. All gas piping including all materials and specialties required for the proper functioning of the work. Connections to all equipment requiring gas connections whether furnished by this Section or not.

   B. Gas service in accordance with local regulations including meter pits if required or shown.

   C. Connection to, modification, extension, replacement, and/or removal of existing system and equipment as required for new work.

PART 2 PRODUCTS

2.01 PIPING MATERIALS

1. Steel pipe with malleable iron fittings unless otherwise required by local authorities. All underground piping shall be coated in accordance with the recommendations of the local utility. Use approved connectors and/or connection details for all equipment. All pipe above 2" dia. shall be welded.

2. All gas pipe shall be painted "yellow" including but not limited to pipe on roof and above ceilings.

3. Label all gas pipes with "GAS – Gas Pressure".

2.02 GAS REGULATORS

1. All gas regulators shall be sized to handle the maximum connected load of equipment regulator serves and for the minimum and maximum pressure requirements of equipment.

2. All gas regulators shall be 15# burst rated. Indoor regulators shall be vented to outdoors and pipe type, termination locations, pipe size per regulator manufacturer.

3. All regulators shall be shipped with the proper spring (color coded), field installation not allowed.

4. All outdoor valves shall have pipe at vent to prevent moisture infiltration.

5. All valves to be installed in strict accordance with all gas company requirements.

PART 3 EXECUTION

3.01 PIPE INSTALLATION

1. All gas piping shall be installed in accordance with the International Fuel Gas Code, NFPA-54 and the recommendations of the local utility including coating, ventilation and/or protection.

2. All gas pipe shall be painted "yellow" including but not limited to pipe on roof and above ceilings.

3. Label all gas pipes with "GAS - Gas Pressure".

3.02 CONNECTIONS TO EQUIPMENT

1. All connections to equipment shall have shut offs and drip legs and shall be in accordance with equipment manufacturer's requirements. All shutoff valves shall have ⅛" NPT plugged tapping for pressure testing. Verify final location and type of connection in field.

2. All connections to movable equipment shall have flexible connections, quick disconnects. All kitchen equipment shall have stainless steel flexible connections.

3.03 COMBUSTION AIR

1. All-natural gas-fired appliances located indoors shall have adequate provisions for combustion air. All combustion air installations shall be installed per NFPA-54/ANSI-Z-223.1, National Fuel Gas Code latest edition, and per local gas company requirements.

3.04 GAS PRESSURE

1. All gas-fired equipment furnished under this Contract shall be rated to operate at minimum 5.0" w.c. gas operating pressure, unless otherwise noted.

2. Prior to installation of gas pipe, this Contractor shall verify the pressure requirement of all gas-fired equipment furnished under this Contract or under other Contracts

3. Where gas pressure exceeds 6.0" WC or where high pressure in excess of 14" WC is utilized, provide pressure regulators in all gas lines where appliances are not rated for higher gas pressure. Pressure regulators shall be sized and installed per manufacturers' requirement. All regulators installed indoors shall be vented outdoors.

2.05 GAS EMERGENCY SHUTOFF

1. Provide a complete gas emergency shutoff system. The system shall consist of;

   A. Control Station

      1. Surface mounted (only allowed on existing masonry walls), ASCO Model 173A20 or approved equal. All other applications; recessed mounted ASCO Model 173A19 or approved equal. Units shall have momentary mushroom push button labeled "Emergency Gas Stop". Upon activation, power to valves is shut off and valves close in 1 second.

      2. Quantity of stations shall be as indicated on plans where more than one station closes solenoid valve. The units shall be controlled so any valve closes solenoid.

B. Solenoid Valve

1. ASCO Series 8215 or approved equal (size to match line size); 2-way normally closed, explosion proof, low pressure gas control, 120V voltage.

C. AC Relay Control Panel

1. ASCO Catalog 108D90C or approved equal recessed mounted, key operated switch with manual on/off buttons, surface mounted on existing masonry walls (Provide additional metal to over sides and wiring).

D. Master Control Station

1. ASCO 216C89 key-operated or approved equal; normally open switch and a normally closed pushbutton mounted in a stainless steel faceplate for flush installation labeled "Gas Valve Control" on the faceplate, and the switches are labeled "Open" over the key switch and "Shut" over the pushbutton with wall box.

E. All wiring per manufacturer's requirements and to be provided by this Contractor.

END OF SECTION
15440.6290

SECTION 15450 - PLUMBING FIXTURES AND EQUIPMENT

PART 1 GENERAL

1.01 SCOPE

1. Furnish and install complete with all necessary trim, hangers, etc., all plumbing fixtures and equipment required for the Contract.

2. All handicapped fixtures shall be installed per American Disabilities Act (ADA) and applicable guidelines.

3. Install all fixtures at heights indicated on architectural plans.

4. Provide all offset piping and special tail pieces per manufacturer requirements to comply with clearances per ADA.

5. Adjust heights of carriers due to depressed floors in toilet rooms.

6. All fixtures, equipment and appurtenances where manufacturer and manufacturers' model numbers are specified, shall be "or approved equal".

PART 2 PRODUCTS

2.01 **P-1** – WATER CLOSETS

1. American Standard "Afwall", (or approved equal) elongated rim, wall mounted bowl, siphon jet with 1½" diameter top spud. Aquameter 2257.103 with Sloan #8111 (or approved equal) battery powered sensor operated flush valve, 1.5 gal./flush. Note: Flush valve requires 25 psi minimum working pressure.

2. Wall mounted fixtures to be mounted so that height of water closet shall be 17" to 19" above finished floor to top of seat.

3. Seats shall not be sprung to return to a lifted position.

4. Flush valves and controls shall be installed in accordance with ADA guidelines Section 4.16.5 and 4.27.4.

2.02 CLOSET SEATS

1. Heavy duty, open front, cut out back, seat no cover, stainless steel check hinge, solid section, high impact white polystyrene seats.

2. Handicapped Applications - Provide seat cover where required to meet requirements of ADA, Section 4.16.5 and 4.27.4.

2.03 **P-2** - WALL HUNG LAVATORIES

1. American-Standard "Lucerne", 20"x18" (or approved equal), vitreous china wall hung lavatory for concealed arms. Handicapped Applications - Mount unit as required to maintain clearances per local codes.

3. All 20"x18" wall hung china lavatories shall be furnished with "TRUEBRO, INC. LAV SHIELD protective enclosure, Model #2018-AS-L1 or approved equal. Lav Shied shall be constructed of rigid high-impact, stain-resistant PVC, 0.093" nominal wall thickness, shall have UV protection and shall be furnished and installed with seven (7) virtually indestructible – tamper resistant stainless screws with wall anchors. Color shall be china white. Lav Shield shall fit all ADA-conforming 20"x 18" wall hung china lavatories. Lavatories shall be paintable with acrylic enamel or latex paint. Lav Shield shall be UL listed in accordance with ADA Article 4.19.4 Flammability Ratings; UL-94 V-0, 5VA ASTM D-635-91 4 (ATB) 2.1 (AEB). Lav Shield shall be listed for bacteria/fungus resistance per ASTM G21 and G22 – Result 0 growth.

2.04 **P-2** – LAVATORY TRIM

1. Sloan (or approved equal) BASYS sensor metering solar powered with battery powered hand washing faucet, sensor operated pedestal Model EFX-375.100.0100 (or approved equal) with below deck Model 170LF (or approved equal) thermostatic lead-free mixing valve and faucet and brass grid strainer. "Handicapped Installation" - Insulate waste and hot water pipes under sink.

2.05 SUPPLIES, TRAPS, CARRIERS, ETC.

1. Provide chrome plated supplies with screw driver stops for all fixtures.

2. Provide traps, deep seal where required, for all fixtures, chrome plated where exposed.

3. Provide Josam (or approved equal) carriers for all wall hung fixtures. All bases, where required, to be block type. with 4"x3" reducing bushings fabricated steel cabinet with flow control and fresh air inlet.

2.06 FLOOR DRAINS

1. **P-3** - Finished Spaces - Josam 30000-S (or approved equal) with square nickaloy strainer of recommended size.

   A. Floor drains installed in tiled floors shall be Josam 30000A (or approved equal) with square nickaloy strainer of recommended size and installed and coordinated with tile layout, so drains are located within the tile pattern in a manner to minimize cutting of tile.

2. **P-5** - Equipment Rooms - Josam 32320 (or approved equal) with sediment bucket with square nickaloy strainer of recommended size with auxiliary inlet for trap primer.

3. Provide Quad Seals J.R. Smith (or approved equal) with deep seal traps for ALL floor drains.

2.07 **P-4** – EMERGENCY EYE WASH

1. Bradley Model S-19 220 DCR or approved equal, 10" dia. bowls, face ring spray, ½" ball valve, hinged stainless steel duct cover, wall bracket, dome strainer. All stainless steel construction.

2. Provide new mixing valve Bradley Model S-19-200. Locate at ceiling with inlet, shutoff and check valves.

2.08 **P-6** – WASH BASIN

1. Wash basins shall be Bradley Model 2703-54" or approved equal; 54" semicircular stainless steel with infrared control LSD liquid soap dispenser with stainless steel backsplash with mixing valve with inlet, check and shutoff valves.

2.09 SHOCK ABSORBERS

1. Josam 75000 Series (or approved equal) in size recommended by P.D.I. on each group of fixtures.

2. Install above chase in ceiling or install where accessible for service.

2.10 SAFEWASTE DRAINS

1. At all safewaste drains, provided trap and funnel and trap primer JR Smith 2699 (or approved equal) on closest water line with ½" dia. coldwater to safewaste.

2.11 BACKFLOW PREVENTERS

1. Provide as indicated on the plans or as required by local codes and/or Water Company, packaged reduced pressure backflow preventers for protection against backflow of pollutants through cross connections due to back pressure or back siphonage.

2. Units shall have two internally spring-loaded check valves which will maintain 1 psi back pressure. Check valve body and trim shall be bronze. Provide shut-off gate valves on either side of check valves.

3. Units shall have pressure differential relief valve installed between the two check valves.

4. Units shall be listed and shall be as manufactured by Hershey "Beeco" #6Cm, Watts #900 or an approved equal.

5. Drain from discharge of unit shall be extended to closest drain with indirect waste connection.

PART 3 EXECUTION

3.01 INSTALLATION

1. All fixtures shall be installed after finished surfaces are complete; they shall be set neat and flush without damage to adjacent surface.

2. All equipment shall be installed in a neat workmanlike manner.

3. All floor mounted fixtures to be set on silicone caulking as further waterproofing.

END OF SECTION
15450.6290

SECTION 15470 - COMPRESSED AIR SYSTEM

PART 1 GENERAL

1.01 SCOPE

1. The work under this heading shall include the furnishing and installation of:

   A. All compressed air piping including connections to all equipment. All materials and specialties required for the proper functioning of the work. Connections to all equipment requiring compressed air whether furnished by this Contractor or not.

   B. Connection to air compressor per manufacturers requirements.

PART 2 PRODUCTS

2.01 MATERIALS

1. Diaphragm Valves: Valves 2" and smaller shall be 150 psi. WSP, 300 psi WOG. Ductile iron body screwed diaphragm suitable for the service. Grinnel Model 2400 or approved equal.

2. Line Filter: 200 psi heavy duty, die cast zinc body, plastic baffles valve type deflectors for removing condensate.

3. Automatic Draining Condensate Trap: Furnish and install undripped low points receivers and where shown, float operated trap to eject water without loss of line pressure. Stainless steel valves components cast iron body and cover. Built in accordance with ASME.

4. Air Line Mist Lubricator: Zinc body clear shatterproof bowl, dual set feed adjustment automatic by-pass.

5. Quick disconnect couplings shall be industrial rated and meet US MIL C4109C.

6. Relief valves shall be adjustable from 55 to 200 psi, Speedair #2X947 or approved equal.

7. Pressure regulator shall be heavy duty industrial type 250 psi maximum input 0# to 125# output Speedair 1Z or 2Z series or approved equal.

2.02 HOSE REELS

1. Hose reels shall be high-performance, heavy-duty reels with spring operated rewind reel and adjustable arm positioning suitable for use with compressed air system. Provide metallic blue baked-on enamel finish. Provide ball stop kit and mounting channel. Reels shall have full-flow swivel with minimal pressure drop. Provide ½" diameter, 35'-0" long hose with ½" diameter NPSM(M) inlet and ½" NPT(M) outlet connections rated for maximum pressure of 300 psi. Provide hose inlet kit with ½" diameter, 2'-0" long hose rated for maximum working pressure of 2,000 psi and quick disconnect fitting. Reels shall be Graco model XD HSM33B or approved equal.

PART 3 EXECUTION

3.01 EQUIPMENT INSTALLATION

1. Provide all mounting materials including vibration. Verify all supports before mounting.

3.02 COMPRESSED AIR PIPING

1. Piping shall conform to ANSI B31.1. All pipe to be sloped to drip points.

END OF SECTION
15470.6290

SECTION 16100 - GENERAL ELECTRICAL

1. GENERAL PROVISIONS

1.1 The applicable provisions of the Division 1 General Conditions, Supplemental Conditions, Special Contract Requirements, Amendments and Additions to the General Conditions, and all project addenda are hereby made an integral part of this section.

1.2 These specifications apply to all electrical work performed.

1.3 When apparent conflict exists between these specifications and the contract drawings, within the specifications, or within the drawings, the engineer will determine the intent.

1.4 The term "provide" means "furnish and install". The terms "contractor", "E.C.", and "EC" mean "electrical contractor", unless otherwise noted. All work indicated in specifications division 16000 and on the electrical drawings is by the electrical contractor, unless otherwise noted.

1.5 The terms "unless otherwise noted" or "unless otherwise indicated" in any form of wording mean "unless specifically indicated otherwise on the electrical drawings, in the electrical specifications, or in the General Conditions and Requirements to the specifications and/or contract". These terms do not mean "unless indicated otherwise on the general construction, mechanical construction, or other disciplines' drawings or specifications", except where specifically so worded on the electrical drawings or electrical specifications.

1.6 Materials and equipment manufacturers and catalog numbers specified constitute the type and quality of design, material, workmanship, ruggedness of construction, resistance to vandalism, exact operating and performance characteristics, features, configuration, dimensions, etc.. Where multiple manufacturers are shown in the drawings and/or specifications, not all manufacturers shown may be capable of providing materials and equipment meeting the specifications, field conditions, etc.. Manufacturers not specifically shown on the drawings or specifications shall be considered, provided the products are equivalent or superior to the requirements of the drawings and specifications (including equivalent or superior to products and/or manufacturers specifically shown on drawings and specifications). Manufacturers, whether shown on the drawings or specifications or not, are acceptable only if they can meet the specifications, conditions, and requirements specific to this project. The terms "equivalent", "equal", "equaling", and "approved equal" mean "equivalent or superior to the item/process specified when approved by the engineer", unless otherwise noted.

1.7 For any equipment indicated on the drawings or specifications as furnished by the owner (or furnished by any other party, including other contractors, subcontractors, or third parties), contact the furnishing party prior to submitting bid to obtain all requirements of such equipment as necessary to provide a complete installation. Provide all ancillary equipment as necessary which is not furnished but which is required for a complete installation of owner furnished equipment.

2. SCOPE OF WORK

2.1 The work governed by these specifications consists of providing all labor, materials, equipment, services, and related items/work necessary to complete all the electrical work as indicated and described in the drawings and specifications.

2.2 Electrical work includes but is not limited to:

A. Electric service and service equipment
B. Power distribution and wiring
C. Interior and exterior lighting
D. Emergency power and lighting
E. Utilization equipment connections
F. Fire alarm system
G. Telephone raceway/pathway system
H. Temporary power and lighting

3. CONTRACT DRAWINGS AND SPECIFICATIONS

3.1 Drawings are diagrammatic and indicate the general arrangement of the various systems and approximate and relative locations of the materials and equipment defined by the specifications. Coordinate with and obtain the approval of the owner, architect, and engineer for the exact locations of all materials and equipment. Check the drawings, specifications, and all fabrication and shop drawings (including fabrication and shop drawings of other trades) to verify space conditions, headroom requirements, characteristics, and for coordination. Where space conditions and headroom requirements appear inadequate, notify the engineer before submitting a bid. No extra consideration, claims, charges, or compensation will be granted under any circumstance for failure to notify the engineer, or for any alleged misunderstanding of the requirements above. Completely furnish, install, connect, and interconnect all components of all systems in accordance with contract requirements, manufacturer's instructions, applicable codes and standards, and best practices of the trade.

3.2 Minor deviations, variations, changes, and corrections from layouts shown on the drawings (based on coordination, conditions, manufacturer's instructions, codes and standards, shop drawings, and verification of measurements and conditions) are permitted to facilitate construction provided the changes do not represent potential changes in scope of work (see the section of these specifications "Changes to the Scope of Work") and provided the changes are acceptable to the owner, architect, and engineer.

3.3 Before submitting bid, examine and check all drawings and specifications relating to all work, including electrical, mechanical, plumbing, general construction, fire protection, and any other trades' drawings and specifications (as well as Division 1 General Conditions) and become fully informed as to the extent and character of work required and its relation to the work of other trades. No extra consideration, claims, charges, or compensation will be granted under any circumstance for any alleged misunderstanding of the work to be performed, or the force and intent of these specifications.

3.4 Fully coordinate (prior to releasing doors and hardware) with the general contractor to ensure that all doors to rooms housing new large electrical equipment swing open in the direction of egress and are equipped with proper "panic" hardware (as per NEC Articles 110.26(C)(3) and 110.33(A)(3), where applicable).

4. VISIT TO SITE

4.1 Before estimating work, visit the project site and verify all measurements and field conditions affecting the work. The contractor is fully responsible for the correctness of all

measurements and for any connections to existing work. Submission of bid is considered evidence that this contractor has visited and examined the site. No extra consideration, claims, charges, or compensation will be granted under any circumstance for extra work as a result of the contractor's failure to visit the site or verify conditions and measurements.

5. VERIFICATION OF MEASUREMENTS AND CONDITIONS

5.1 The electrical contractor is solely responsible for verifying field measurements, conditions, and drawing and specifications information (for all trades) before ordering materials and equipment and before commencing work. The electrical contractor is solely responsible for verifying shop drawings (including shop drawings of other trades) before releasing related materials and equipment and before rough in. No extra consideration, claims, charges, or compensation will be granted under any circumstance due to any differences between the actual dimensions and any dimensions indicated on the drawings.

5.2 Report any apparent discrepancies or conflicts found at once to the engineer for consideration and wait for a decision before proceeding with any work in the affected area.

5.3 The engineer's decisions in cases of discrepancies, conflicts, and related to verification of measurements and conditions are final and binding upon the contractor, make all installation accordingly.

6. EXISTING CONDITIONS AND UTILITIES

6.1 Information and data indicated on the drawings regarding existing conditions (including underground utilities) is from the best available sources. However, no assurance is made as to completeness and/or accuracy.

6.2 Contact all utility companies operating in the project vicinity (water, gas, sewage, electric, telephone, cable television, etc.) and the owner's maintenance department (where applicable) and verify all existing underground systems before any excavation commences. Utilize applicable "one-call" or "before you dig" utilities marking services, including paying all associated fees.

6.3 Relocate any existing underground electrical feeders and wiring in areas of construction and around proposed foundations as applicable. Include all costs in bid. If any third-party owned wiring or equipment interferes with construction, notify the engineer.

7. ITEMS NOT SHOWN OR SPECIFIED

7.1 Provide any items of material not indicated on the drawings and/or not specified, but which are required for the complete and proper installation and/or operation of any part of the work, as if indicated and specified.

7.2 Provide any work not indicated on the drawings and/or not specified, but which is required for compliance with applicable codes and regulations, as if indicated and specified.

7.3 No extra consideration, claims, charges, or compensation will be granted under any circumstance for performing work required for complete and proper installation/operation or required for compliance with applicable codes and regulations.

8. REGULATIONS AND CODES

8.1 Perform work in accordance with all respective requirements of the latest adopted editions (as of the date of electrical construction permit approval) of all applicable federal, state, and local codes, standards, regulations, ordinances, laws, etc. and industry standards. This includes applicable requirements of the National Electrical Code (NEC), National Fire Protection Association (NFPA), American National Standards Institute (ANSI), Americans with Disabilities Act (ADA) (as well as all related state disabled access and/or barrier free codes and standards and ANSI A117.1), International Building Code (IBC), International Energy Conservation Code (IECC), International Residential Code (IRC), Factory Mutual (FM), Illuminating Engineering Society of North America (IES, IESNA), Institute of Electrical and Electronic Engineers (IEEE), Insulated Power Cable Engineer's Association, National Electrical Contractors' Association (NECA) "Standard of Installation", National Electrical Manufacturer's Association (NEMA), National Electrical Safety Code (N.E.S.C.), Underwriter's Laboratories (UL), United States Department of Labor Occupational Safety and Health Administration (OSHA), utility companies requirements, etc..

8.2 Where listing or labeling (in any form, i.e. UL, CSA, ETL, etc.) is indicated in the drawings or specifications or is otherwise required by the NEC or other applicable code, provide equipment and materials as either listed or labeled by a qualified product evaluating organization (UL, CSA, ETL, or approved equal) acceptable to local authorities having jurisdiction. Include all costs in bid. No extra consideration, claims, charges, or compensation will be granted under any circumstance associated with providing listed equipment.

A. The electrical contractor is fully responsible for verifying (before submitting bid) the applicability and extent of code required listing with local authorities. Specifically verify if the municipality has any requirements that "listable" (capable of being listed) products must be "listed". Provide accordingly where applicable.

B. Submission and/or approval of shop drawings (which may or may not show listing) do not relieve the contractor of the responsibility to meet listing requirements.

C. Where products required (by specifications/code) as listed are installed without listing or as non-listed (without prior written approval), the contractor shall remove the products and install listed products at no cost to the owner. Written approval will only be considered if all of the following are satisfied:

1) The contractor is fully responsible for (including all costs) and must prepare and submit any and all information necessary for review and evaluation of products (by the authority having jurisdiction, engineer, architect, and owner). This includes all processing costs for all parties involved and costs for any special or independent third party inspections, investigations, evaluations, engineering services (including sealing by a registered professional engineer), etc. which may be required or requested in conjunction with approval. In the absence of listing, the contractor is fully responsible for proving that products are acceptable.

2) The contractor must show one (1) or more of the following:

a) That listed products are not available.
b) That providing available listed products involves excessive costs or hardships.
c) That listing of products involves requirements that unreasonably exceed the requirements of the specifications, codes, and project conditions.

3) Products must meet or exceed all specified requirements, industry standards, code requirements, and conditions specific to the project.

4) There must be no change in contract price (except that the owner reserves the right to require credit pricing).

5) Where acceptable to the owner.

8.3 Where NEC article numbers are referenced in the drawings and specifications, they apply to the latest edition. Where the authority having jurisdiction has not adopted the latest edition, refer to the corresponding applicable code requirement article.

9. PERMITS, CERTIFICATES, AND FEES

9.1 Apply for, obtain, pick-up, and pay for (pay all costs associate with) all permits, licenses, certificates, etc., required for execution of the project. Procure all permits immediately upon notice to proceed with the contract. The contractor is fully responsible for verifying all permits, licenses, certificates, etc. which are required. Submit (see the section of these specifications "Summary of Submissions") copies of all permits, licenses, certificates, etc. in conjunction with this project for record. Prepare all information and data for submittal to any authority in order to obtain permits and certification of compliance for the permits. This specifically includes this contractor reproducing contract drawings for permit submission, which shall be sealed by the electrical engineer upon request.

9.2 Obtain and submit (see the section of these specifications "Summary of Submissions") six (6) copies of inspection certificate(s) from authorities having jurisdiction indicating approval of the electrical installation. Arrange and pay for all electrical inspections (performed by an approved Underwriters Inspection Agency) associated with inspection certificate(s).

9.3 Applicable utility service charges will be paid directly by the owner. Obtain and submit (see the section of these specifications "Summary of Submissions") written estimates from all respective utility companies prior to utilities performing work.

9.4 If and when requested by the owner or owner's representative, the electrical contractor shall submit to the owner any information necessary as part of the owner's application or submission for applicable grants, rebate programs, reimbursement programs (including, but not limited to, energy rebate programs such as "smart start" or "clean energy"), or other similar/related programs. Submit all required documentation, including, but not limited to, detailed pricing information on materials and/or labor, bills of materials, invoices, receipts, counts, take-offs, other related cost information, submittals, shop drawings, etc.. Compile information in format as directed by the owner or owner's representative including tables and other formats as requested.

10. GUARANTEE AND WARRANTIES

10.1 The electrical contractor is fully responsible to guarantee all electrical equipment and work (applies to all materials and equipment, including lamps for luminaires) and is fully responsible for all manufacturers' warranties from material purchase (by the contractor), through the date of final acceptance by the owner, to the expiration date(s) of the guarantee and warranties. Guarantee and provide warranties for a period after the date of final acceptance by the owner as per Division 1 General Conditions, unless longer periods are specifically indicated otherwise on the electrical drawings or specifications. Guarantee/warranty periods of less than two (2) years after date of final acceptance are not permitted under any circumstance.

10.2 Wherever "warranties" are indicated elsewhere in the specifications, provide and submit (see the section of these specifications "Summary of Submissions") written manufacturers' warranties for equipment. Include all costs in bid associated with providing specified warranties periods (including purchasing any required extended or special warranties to meet the specified periods). Submission of written warranties showing periods, conditions, or coverage of less than the periods, conditions, and coverage specified does not relieve the contractor or manufacturers' of the responsibility to provide warranties with periods, conditions, or coverage as specified. Manufacturers' warranties do not relieve the contractor of any responsibility associated with the electrical contractor's guarantee.

10.3 The electrical contractor shall guarantee and respective manufacturers shall warranty equipment and materials from defects in workmanship, materials, and operation. Provide guarantee/warranties including all service, maintenance (excluding routine maintenance), materials, labor, travel, all other work, and all expenses required as part of guarantee/warranties. Provide all guarantee/warranties service at no extra cost to the owner under any circumstance. Provide all guarantee/warranties service in timely manner.

10.4 Completely replace or repair, to the satisfaction of the owner, any equipment (as part of this project) improperly installed or damaged before or after installation until expiration of the guarantee period. Completely replace or repair, to the satisfaction of the owner, any equipment (including existing equipment and equipment installed by any other contractor or party) damaged by the electrical contractor (or any subcontractor thereof).

11. SEQUENCE OF WORK

11.1 Perform work in areas or general sequences (including applicable project phasing) as determined and directed by the owner and architect. Submit (see the section of these specifications "Summary of Submissions") a complete schedule of construction for approval, showing delivery of equipment, erection of equipment, pertinent work related to installation, and when equipment will be placed in operation. Fully coordinate exact sequencing, phasing, and scheduling with all contractors, the architect, and the owner in detail and obtain approval of sequencing, phasing, and scheduling before starting work.

11.2 Perform all work in such a manner and associated with sequencing, phasing, and scheduling as applicable and include all costs and manpower allocations in bid. For example, to complete a particular sequence or phase of the work, it may be necessary to perform work in physical areas of the project areas which are covered by and/or part of prior phases or subsequent phases of work (i.e. work in initial phases of the project may involve installing the electrical service and electrical distribution equipment in areas which

are proposed for renovation as part of a later phase; this would require installing the electrical service and electrical distribution equipment as part of the initial phase). Verify all such conditions, implications, requirements and include costs in bid. No extra consideration, claims, charges, or compensation will be granted under any circumstance for sequencing, phasing, and scheduling.

11.3 Maintain service at all times (except as provided elsewhere in the drawings and specifications for shutdowns) and minimize disruptions to all active areas, activities, and operations in and around the scope of work. This specifically includes activities and operations of the owner, third parties in the vicinity of the project, roads and highways surrounding the project, and utility companies serving the project. Coordinate specific requirements with the owner before submitting bids.

11.4 Maintain service of life safety systems (specifically emergency lighting and fire alarm) at all times.

A. As a minimum, maintain the following during construction (except brief periods, not exceeding one (1) working day, while making connections to or transitions between existing, proposed, and temporary systems [where applicable]):

1) Maintain code compliant emergency lighting in all occupied areas of the building. Emergency lighting is not required in unoccupied areas and other areas closed to use by building occupants.

2) Maintain manual fire alarm operation throughout the entire building (including areas under construction). This includes manual pull stations (existing, proposed, and/or temporary) at all active building means of egress exits (i.e. exits from each floor to stairwells or the exterior). This includes audible signaling devices to adequately warn building occupants and construction personnel (visual signaling is not required and signaling is not required to comply with the ADA during construction).

3) Maintain supervision of all active sprinklers in the building. This includes monitoring flow, tamper, and pressure switches.

4) Maintain service to automatic fire detection as much as practical. Automatic fire detection is not required to operate in areas of construction at times when construction personnel are present (who can activate manual fire alarms). Other shutdowns of automatic fire detection may be considered, if approved in writing by the owner.

4) Whenever ADA approved signaling is not operational during construction, the electrical contractor's construction personnel shall be instructed with and shall carry out procedures to manually notify any disabled building occupants of fire emergencies (*this provision does not apply if the existing fire alarm system is not ADA compliant or is not present*).

5) Whenever HVAC duct smoke detection systems are not operational during construction, the electrical contractor is responsible for maintaining clear and unobstructed access to HVAC controls and/or disconnecting means (to facilitate manual operation in the event of a fire).

B. To satisfy requirements above, any existing and proposed life safety systems may be used as much as practical. Where requirements cannot be satisfied using existing/proposed systems, provide suitable temporary life safety systems (including all associated temporary wiring) as applicable.

C. Whenever unable to meet the above requirements, the electrical contractor (at the electrical contractor's expense) shall provide continuous fire watch.

12. CHANGES TO THE SCOPE OF WORK

12.1 Changes to the scope of work include any change effecting the overall nature or cost of the project. Examples of changes to the scope of work include, but are not limited to, additions or deletions of equipment or items of work, substitutions not equivalent or superior to equipment specified, substitutions with characteristics or operation varying from equipment specified, changes which effect the ultimate use or functioning of equipment or areas of the building, changes considered to be "substantial", any change which any party (contractors, sub-contractors, owner, architect, engineers, etc.) believes may involve a possible change in contract price, etc..

12.2 Make all changes to the scope of work in complete accordance with the general conditions of the specifications. Submit (see the section of these specifications "Summary of Submissions") changes to the scope of work immediately upon proposal of changes. Do not proceed with any work associated with or affected by changes to the scope of work unless the owner approves changes in writing or authorizes proceeding in writing.

12.3 All applicable provisions of the contract drawings and specifications, including addenda and prior changes, apply to all changes to the scope of work, unless specifically indicated otherwise.

12.4 In addition to all requirements of the general conditions, submit all pricing related to changes to the scope of work as indicated below. Pricing will not be reviewed until the required breakdowns (summarized below) are submitted.

12.5 Submit pricing for a proposed change to the scope of work with detailed breakdown as follows.

A. Submit a complete detailed breakdown of all material associated with the proposed change in scope of work. Itemize each unit of material and the respective cost.

B. Submit a complete detailed breakdown of all labor associated with each respective item of the above material breakdown. Itemize labor hours and classification for each item of material. Summarize total labor costs, broken down by worker classification and/or billing rate.

12.6 Where instructed to proceed with a change to the scope of work on a time-and-material (T&M) basis, submit pricing with detailed breakdown as follows.

A. Submit a complete detailed breakdown of all material. Submit copies of all receipts, invoices, and stock material lists.

B. Submit a complete detailed breakdown of all actual labor hours. Submit copies of time sheets. Summarize total labor costs, broken down by worker classification and/or billing rate.

13. TEMPORARY POWER AND LIGHTING

13.1 For this specification section only, the term "responsible" (in any form) means "responsible to pay all costs (pay to the electrical contractor) to erect the described work". For this specification section only, the term "erect" (in any form) means "furnish, install, maintain, and remove".

13.2 The electrical contractor is responsible for temporary power and lighting service/source and distribution during construction. Provide service capacity sufficient for construction. Provide service including any required utility or private metering.

13.3 The electrical contractor is responsible for all temporary lighting, all 120 V power for small construction tools, and all other temporary power not exceeding 120 V or 20 A. Power for large tools and equipment exceeding 120 V or 20 A (including arc welders, etc.) is the responsibility of the contractor requesting such power. Temporary power during construction (exceeding 120 V or 20 A) to permanent equipment installed as part of this project (for installing, testing, operating, etc., including mechanical equipment, elevators, etc.) is the responsibility of the contractor requesting such power.

13.4 Where a general contractor's construction trailer is present, the electrical contractor is responsible for a minimum 60 A, maximum 200 A single phase service to the trailer. Provide service including any required utility or private metering. Temporary service to any other contractor or subcontractor trailer is the responsibility of the contractor requesting such service.

13.5 Where utility power is not available and during shutdowns of utility power, the contractor requesting power under these conditions is responsible for providing portable generator(s), associated temporary wiring, and fuel (sufficient to meet power requirements during these conditions). Generator power to owner loads during construction is not required (unless specifically indicated on the drawings).

13.6 The electrical contractor is responsible for temporary power to existing and/or other owner loads, equipment, and wiring as indicated on the drawings.

13.7 The electrical contractor shall erect all temporary power equipment and wiring for a complete temporary power installation, regardless of the contractor who is responsible for the temporary power.

13.8 Erect all temporary power and lighting during construction in accordance with OSHA and the NEC. This includes required ground fault circuit interrupter (GFCI) protection for personnel and "assured grounding program".

14. TESTING

14.1 After completing installation of equipment and wiring and prior to energizing or placing in service, test all electrical equipment, conductors, systems, and each and every part thereof to insure continuity, proper splicing, freedom from unwanted grounds, acceptable

insulation values, proper operation and functioning, and a complete workmanlike installation to the satisfaction of the engineer and owner.

14.2 Completely test all equipment installed. This includes all equipment furnished and installed by the electrical contractor as well as equipment furnished by others and installed by the electrical contractor and equipment furnished and installed by others and wired by the electrical contractor.

A. Electrical tests of panels, switches, and circuit breakers rated 800 A and less and 600 V and less are not required, except that meg-ohm meter testing is required.

B. Electrical tests of motors 75 kW (100 hp) and less are not required.

C. Electrical tests of individual motor starters are not required. This does not apply to motor control centers (where applicable), where complete testing is required.

D. Visual and mechanical checks are required for all equipment (including all panels, switches, circuit breakers, motors, motor starters, and all other equipment) without exception.

14.3 Test all equipment and wiring as per the latest edition of InterNational Electrical Testing Association (NETA) standards (Acceptance Testing Specifications (NETA-ATS) for new equipment/wiring and Maintenance Testing Specifications (NETA-MTS) for existing equipment/wiring), unless indicated otherwise. For each piece of equipment, perform testing as shown for that equipment in respective NETA standards. Where equipment is not specifically shown in NETA standards, perform testing as shown for equipment most closely resembling the equipment to be tested. Perform all tests shown in respective NETA standards, unless indicated otherwise. Tests shown as "optional" in NETA standards are not required unless specifically indicated otherwise on the drawings or specifications. Utilize suitable instruments in making all tests, as per NETA standards. Battery, magneto, or similar hand-held testers may be used for preliminary conductor continuity checking but are not acceptable for final results, which must be obtained utilizing proper equipment only (i.e. meg-ohm meter, etc.).

14.4 Provide all testing performed by a NETA accredited independent testing firm employed by the electrical contractor, unless indicated otherwise. Provide visual and mechanical checks shown in the NETA standards, testing of transformers 225 kVA and less (with primary and secondary voltages 600 V and less only), and testing of panels, switches, and circuit breakers 1,200 A and less and 600 V and less performed by the electrical contractor's direct employees or by the independent testing firm (at the contractor's option). Provide continuity and insulation resistance meg-ohm meter testing of 600 V and less conductors performed by the electrical contractor's direct employees only.

14.5 If requested by the owner or engineer, utilize a recording type (i.e. "Dranetz") meter to measure phase-to-phase voltage, phase to neutral voltage, phase currents, harmonic content, and surges in the system. Perform testing for a period of one (1) week. Completely set up and take down meter and submit printout tapes formal test results.

14.6 For all testing performed, submit (see the section of these specifications "Summary of Submissions") complete typewritten and tabulated test results for review and approval by the engineer and owner. Submit test result bound together in a single three-ring binder (one

(1) binder per set of test results) including a table of contents. Submit quantity of sets as directed in the General Construction specifications, but in no case less than three (3) sets. Submit results upon project completion, except under conditions below.

14.7 Where any abnormal, questionable, "failing", or "borderline" test results are encountered or where discrepancies are noted during testing, submit results immediately to the engineer before energizing equipment. Do not energize until authorized in writing by the engineer. Test results submitted under these circumstances are not required to be bound or complete.

14.8 Where connecting to or otherwise modifying existing wiring, test wiring as follows.

A. Test existing wiring before performing work to confirm integrity (where testing is performed, the electrical contractor is not responsible for the prior existing condition of wiring).

B. Test new wiring before connecting to existing wiring.

C. Test connections of new to existing wiring (test new wiring and existing wiring together) and modified existing wiring after performing work.

Where this testing is not performed, the condition of existing wiring will be assumed to be a direct and sole result of work preformed and the electrical contractor will be held fully responsible for the condition of existing wiring. Where this testing is not performed and where existing wiring is not in acceptable condition for maintained use or service, the electrical contractor shall repair or replace wiring to the satisfaction of the owner at no cost to the owner.

14.9 Provide oscilloscope testing of all variable frequency drives (VFD's) installed as part of this project (with power wiring installed by the electrical contractor), including VFD's furnished by the mechanical contractor, other contractors, or the owner and including VFD's in motor control centers (where applicable). Perform oscilloscope testing to determine the presence/magnitude of voltage surges (at the VFD carrier frequency level, approximately 15 kHz to 25 kHz) associated with reflected wave phenomenon. Perform testing by making oscilloscope measurements at the VFD load terminals and at the motor line terminals (or at the disconnecting means local to the motor where motor terminals are not practical). Record oscilloscope readings with a suitable oscilloscope type "Polaroid" camera (or other recording means which accurately displays equivalent graphic information) and compare readings at the VFD with readings at the motor. Submit photographs with test results. Oscilloscope testing is not required for a VFD located directly adjacent to the motor served, provided the VFD and motor manufacturers submit written certification showing that the complete motor/VFD installation is fully coordinated (including considering reflected wave phenomenon); the electrical contractor is responsible for obtaining this written certification.

15. SUBSTITUTIONS

15.1 Materials and equipment manufacturers and catalog numbers specified constitute the type and quality of design, material, workmanship, ruggedness of construction, resistance to vandalism, exact operating and performance characteristics, features, configuration, dimensions, etc.. The engineer will consider substitutions of similar equipment superior to specified equipment (meeting or exceeding all characteristics of the specified equipment).

15.2 Submit shop drawings associated with substitutions complete with documentation necessary to establish compliance with the specifications (see the sections of these specifications "Shop Drawings" and "Summary of Submissions"). Submit samples of substitutions where requested (see the sections of these specifications "Samples" and "Summary of Submissions"). If documentation and/or samples are not submitted when required, the request for substitution will be denied.

15.3 Determination of compliance with specifications rests with the engineer. When a request for substitution is denied, furnish the equipment specified. The engineer's decisions in cases of substitutions are final and binding upon the contractor, provide equipment accordingly.

15.4 Pay all costs associated with a substitution where granted. For the provisions of this section, "substitutions" includes equipment where characteristics or operation vary significantly from equipment specified (including equipment of the specified manufacturer). This includes costs incurred by any party (electrical contractor, other contractors, sub-contractors, owner, architect, engineers, etc.), costs resulting from differences of details, configuration, ratings, operation, characteristics, and dimensions between the specified and substituted equipment, costs to provide features of the specified equipment which may be manufacturer's options of the substituted equipment, and costs to remove and replace work already installed and any other remedial work as a result of substitutions. Approval of substitutions is conditional upon there being no cost change to the contract, unless specifically indicated on the shop drawings submittal and corresponding approval. The electrical contractor is fully responsible for coordinating with the owner, architect, and other trades to identify all possible cost impacts associated with any substitution before releasing equipment and before any party proceeds with work effected by the substitution.

15.5 Submit bid based on the items as specified. Substitutions will be considered only after a contract has been awarded.

16. SHOP DRAWINGS

16.1 Submit a product list indicating all proposed items of products, materials, and equipment as directed in the general construction specifications.

16.2 Submit (see the section of these specifications "Summary of Submissions") shop drawings of all equipment and materials proposed to be furnished for review and approval by the engineer. Submit quantity of sets as directed in the general construction specifications, but in no case less than ten (10) sets.

16.3 Submit shop drawings for all equipment and materials including, but not limited to luminaires, solid state energy saving ballasts, raceways, conductors, cable, termination methods, grounding, wiring devices, safety switches, enclosed circuit breakers, branch and distribution panels, transformers, contactors, time clocks, photocells, fire alarm system, emergency power and lighting system equipment, engraved plastic nameplates, and any other items requested by the owner, architect, any code official, or engineer.

16.4 Stamp or mark shop drawings with the contractor's approval, as evidence that they were checked for accuracy and that all dimensions, characteristics, ratings, operation, features, data, relation to existing conditions, and coordination with work and shop drawings of other

trades were completely verified before submission. Approval of shop drawings by the engineer does not relieve the contractor of responsibilities to review shop drawings in detail, to comply with drawings and specifications, for errors contained in shop drawings, for coordination, and to provide equipment as listed.

16.5 Where any characteristics, ratings, operations, or features differ from the specified equipment (where not equivalent or superior to the characteristics, ratings, operations, and features of the specifications and specified equipment), circle, highlight, or otherwise clearly designate and identify the specific differences.

16.6 In the event that shop drawings are not acceptable to the engineer (including as provided below for conditional approval), submit acceptable shop drawings within seven (7) days of notification.

16.7 Approval of shop drawings, including approval of substitutions, is conditional that there is no cost change to the contract, unless specifically indicated on the shop drawings submittal and corresponding approval.

16.8 Approval of shop drawings is conditional upon the contractor fully and completely complying with all review comments by the owner, architect, and engineer. Where the contractor fails to or is unable to fully and completely comply with every review comment, then the shop drawings are *disapproved* (whether or not they are stamped or noted as "approved" in any manner in any review comment) and must be resubmitted as within seven (7) days (as indicated above). Immediately upon receipt of shop drawing review comments, the contractor is responsible for carefully reviewing all comments in detail and for complying with comments. Where unable to fully satisfy any comment or where the contractor takes exception to any comment, revise and resubmit acceptable shop drawings (or, where taking exception, notify the engineer in writing) within seven (7) days. Where the contractor fails to comply with these requirements (including resubmitting/notifying within the seven (7) day period specified), the contractor shall provide acceptable equipment meeting all specified requirements and all review comments (including removing unacceptable equipment [if installed] and replacing with acceptable equipment) at no cost to the owner.

16.9 Do not release equipment until shop drawings are approved. The electrical contractor is responsible for all changes where equipment is released before approval and/or where equipment does not comply with all approval conditions.

16.10 In addition to the quantity of shop drawings submitted for approval (see above), submit one (1) copy of *approved* shop drawings to the general contractor, the mechanical contractor, and each other contractor and trade for review and coordination. The electrical contractor is not required to submit copies direct to subcontractors or vendors to other contractors (this is the other contractors' responsibility). The electrical contractor is responsible for all changes and other costs where the electrical contractor fails to submit shop drawings to other parties for coordination.

16.11 Obtain copies of all shop drawings relating in any way to electrical work from all other contractors, subcontractors, and trades. Review shop drawings and coordinate with electrical work. Notify the architect and engineer immediately where discrepancies are found. The electrical contractor is responsible for all changes and other costs where the electrical contractor fails to obtain shop drawings or fails to coordinate shop drawing

information. Approval of other trades submittals by the architect or engineers (or lack of review by the architect or engineers) does not relieve the electrical contractor of the responsibility to review other trades shop drawings in detail and for coordination.

16.12 No extra consideration, claims, charges, or compensation will be granted under any circumstance associated with any party's failure or delay in properly submitting, transmitting, obtaining, reviewing, and/or coordinating shop drawings.

17. SAMPLES

17.1 Submit (see the section of these specifications "Summary of Submissions") samples of materials and equipment for approval only where specifically requested by the owner, architect, or engineer. Submit samples along with complete catalog data, installation instructions, operating and maintenance (O&M) information, etc. specifically applying to the samples submitted, to facilitate proper evaluate the quality of the sample. Specifically designate and identify each sample as to the service and location where each sample is to be used on the project.

17.2 Submit samples within 30 days of the engineer's request, except where the sample is ancillary to a substitution. Where samples are ancillary to a substitution, submit samples within seven (7) days of the engineer's request.

18. AS-BUILT DRAWINGS, MANUALS, AND DEMONSTRATION

18.1 Prepare and submit (see the section of these specifications "Summary of Submissions") as-built record drawings showing conditions exactly as installed.

A. Indicate the exact locations and elevations of all equipment and devices and underground, concealed, and hidden work (including raceways, junction and pull boxes, etc.).

B. Indicate exact layout, connections, and conductor routing for all grounding.

C. Indicate all substitutions and changes, including updated lighting fixture/luminaire schedule, symbol list, list of alternates, etc..

D. For underground work, specifically indicate exact conditions accurately. Where underground wiring does not run straight and direct between visible and obvious equipment, objects, or markers (i.e. markers specifically placed to identify underground work [specifically note the presence and approximate location of all markers on as-built drawings]), clearly, accurately, and exactly *mark* and *dimension* exact underground work (including all bends) from visible permanent landmarks. Acceptable visible permanent landmarks include building walls, retaining walls, curbs, foundations, pole bases, etc.. Lines, joints, and markings on pavements are not considered permanent (since they would be covered by re-paving). Acceptable markers for placement to identify underground work include a 0.9 m (3'0") long piece of 102 mm (4") conduit installed vertically in the ground (top flush with grade) completely filled with concrete (or other similar means providing equivalent or superior visibility, durability, and permanence approved by the engineer). Where the

contractor does not include this exact marking/ dimensions on as-built drawings or where marking/dimensions are inaccurate (allowing for a tolerance of not greater than 0.6 m (2'0") away from actual locations), the electrical contractor will be held responsible if underground facilities are damaged in the future (where due to lack of or inaccurate marking/ dimensioning).

18.2 During the progress of work, maintain accurate records of all deviations, variations, changes, and corrections from layouts shown on the drawings/specifications on a "record working" set of drawings and specifications kept at the job site for this purpose.

18.3 Upon completion of work, incorporate all information from the "record working" drawings/specifications onto a "marked-up as-built" set of drawings/specifications. Submit the "marked-up as-built" drawings/specifications to the engineer for review, comment, and approval.

18.4 Following approval of "marked-up as-built" drawings/specifications, prepare "final as-built" drawings (utilizing the latest version of Autocad (or compatible) software) and specifications (utilizing the latest version of Microsoft Word (or compatible) software). Submit one (1) set of "final as-built" drawing/specifications originals, sets of "final as-built" copies as directed in the general construction specifications (but in no case less than three (3) sets), and "final as-built" drawings/specifications in electronic Autocad (drawings), Word (specifications), and PDF (drawings and specifications) formats. Submit photocopies of all panel circuit directories with "final as-built" drawings.

18.5 Submit operating and maintenance (O&M) manuals for all new equipment furnished as part of this contract. Provide O&M manuals including installation, operating, and maintenance instructions for the equipment. Wherever "proof-of-purchase" is required as part of any manufacturer's warranty (whether manufacturer's warranty is specified or not), submit with O&M manuals. Where any proof-of-purchase is required but not submitted (or where insufficient information is submitted), the electrical contractor is fully responsible and liable for providing the warranty. Submit all O&M manuals bound together in a single three-ring binder (one binder per set of manuals) including a table of contents. Submit quantity of sets as directed in the general construction specifications, but in no case less than three (3) sets.

18.6 Explain and demonstrate the complete electrical system and all work installed by the electrical contractor to the owner's operating and maintenance personnel. Demonstration is to instruct owner's personnel in the operation and maintenance of systems as well as to prove to the owner correct and adequate operation of all parts of the electrical system. Provide a demonstration period of one (1) full working day for the general electrical installation (including, but not limited to, contactors, time clocks, customer metering equipment, lighting controllers, dimming cabinets, motor controls [where furnished by the electrical contractor], transformer fan controls, generators, transfer switches, key interlocking schemes, and similar equipment, where applicable). Wherever demonstrations are indicated elsewhere in the specifications for equipment furnished by the electrical contractor (i.e. for fire alarm, dimming, sports lighting, stage lighting, UPS units, MCC's, VFD's, metal clad switchgear, power management, sound/paging, security, CCTV, and similar systems, where applicable), provide the specified additional demonstrations during additional periods of time (above and beyond the period above for the general electrical demonstration). Conduct all demonstrations at the project site and after all systems are fully operational.

19. SUMMARY OF SUBMISSIONS

19.1 Submit items as indicated elsewhere in the specifications (applicable sections are shown for convenience) and as summarized as follows. Information below indicates relative schedule of submission.

19.2 Submit upon commencement of construction (as per general construction specifications); resubmit within seven (7) days of notification:

A. Permits, licenses, certificates (see 16100-9)
B. Schedule of work (see 16100-10)
C. Product list (see 16100-17)
D. Shop drawings (see 16100-17)

19.3 Submit within 30 days of request (within seven (7) days for substitutions):

A. Samples (see 16100-18)

19.4 Submit during the project as applicable (refer to respective specifications sections for conditions and schedule of submission):

A. Utility service charge estimates (see 16100-9)
B. Scope of work changes, w/ breakdowns (see 16100-11)
C. Test results, abnormal/failing only (16100-15)
D. Short circuit, coordination, and arc flash report (where specified for adjustable circuit breakers)

19.5 Submit upon substantial completion of the project:

A. Approved inspection certificate(s) (see 16100-9)
B. Written manufacturers' warranties (see 16100-14)
C. Test results (see 16100-15)
D. As-built drawings (see 16100-19)
E. O&M manuals (see 16100-19)
F. Spare parts (where specified elsewhere)

20. SAFETY

20.1 Perform all work and work practices in strict accordance with all applicable local, state, and federal codes, standards, regulations, and requirements including OSHA (including the proper use and maintenance of personal protective equipment (PPE) and clothing), state labor and industry, the NEC, ASTM, the National Electrical Safety Code, NFPA, etc..

20.2 The term "live" means "energized or capable of being energized at any time for any reason, either intentionally or accidentally".

20.3 Suitably protect all live equipment against accidental contact at all times. Install and maintain covers on all live equipment. Where covers are not installed, provide suitable insulating barriers at all live parts. Suitable barriers include arc-resistant NEMA GPO-2 or GPO-3 and UL 94 V-0 electrical grade fiberglass reinforced epoxy compound sheets,

rubber insulating blankets, suitable thermoplastic insulating materials, etc. as per OSHA, ASTM, and the NEC. Cardboard and similar materials are not acceptable. Provide listed OSHA approved signs reading "Danger: High Voltage" at locations of live parts and on doors/gates leading to rooms/fences/areas containing the equipment and keep doors/gates locked at all times.

20.4 Protect and enclose equipment operating at over 600 V at all times. Equipment is considered adequately protected where all requirements of NEC Articles 110.26 through 110.34 (including all other articles and codes referenced therein) are satisfied at all times. Where equipment must be exposed for work, or where work is to be performed around normally exposed live parts, provide suitable insulating barriers (suitable for the voltage involved), listed warning signs, and door/gate locking, etc. as shown above. Provide listed OSHA approved warning tape (reading "Danger: High Voltage") around the equipment and all code required working spaces at equipment.

20.5 When working on equipment or wiring, properly identify and use lockout devices and tags (in accordance with OSHA requirements) to prevent unauthorized or accidental energizing of equipment and wiring.

20.6 Perform all work in or associated with confined spaces (including manholes, hand holes, vaults, crawl spaces, etc.) in accordance with all safety codes referenced above. Obtain appropriate permits where required by the above codes and/or the owner.

20.7 Perform all excavation and work in and associated with excavation in accordance with all safety codes referenced above (include all required sloping, benching, shoring, bracing, supporting, shields, protective systems [fall protection, protection of personnel in excavation, protection of structures, etc.], ramps, access/egress, warning systems, rescue equipment, etc.). Provide suitable barricades and safety procedures to restrict pedestrian and vehicular access to areas where work is being performed (including open excavations, lay-down areas, clearance space around operating excavation equipment, etc.). Do not leave excavations open when not actually performing associated work (including at night, during week ends, or when working away from excavations). Leaving excavations open for short periods of time will be considered only when approved in writing by the owner and only where suitably protected. Any request for owner's approval must include a written plan on proposed protection and safety procedures. No extra consideration, claims, charges, or compensation will be granted under any circumstance for any multiple excavations and backfilling needed to satisfy safety requirements.

20.8 When working in, on, or near areas subject to vehicular traffic (including public and private roadways, driveways, parking lots, etc. and including loading and unloading equipment/materials in the vicinity of traffic), perform all work and provide appropriate work zone traffic control in accordance with all safety codes referenced above as well as state department of transportation regulations, requirements, and recommendations. Where requested by the owner, architect, or engineer, submit a traffic control plan detailing proposed work zone traffic control and associated safety procedures.

21. HAZARDOUS MATERIALS

21.1 The electrical contractor is not responsible for and is not required to remove equipment contaminated by hazardous materials, except as indicated below. For this specification section, the term "hazardous material(s)" applies to any materials classified by federal,

state, or local authorities having jurisdiction as environmental or health hazards (including, but not limited to, polychlorinated biphenyls (PCB's), asbestos, mercury, radioactive materials, etc.). For this specification section, the term "contaminated" (in any form) means "contains or is contaminated by hazardous material(s)".

21.2 The electrical contractor (and all applicable subcontractors) shall be fully insured for performing all work related to, on, and around contaminated equipment and for all work specifically shown in this specifications section as by the electrical contractor. Submit proof of insurance to the owner as part of or along with other applicable insurance submittals (as per Division 1 General Conditions, Supplemental Conditions, and Special Contract Requirements).

21.3 Immediately notify the owner if any electrical equipment or wiring to be removed or modified as part of this project is contaminated or suspected as contaminated. Identify all areas where disruptive work is proposed (including, but not limited to, excavation, cutting, penetration, drilling, etc.) in advance of performing work so the owner can arrange to have any necessary abatement completed, include all costs and schedule time accordingly. No extra consideration, claims, charges, or compensation will be granted under any circumstance for any delays resulting from abatement of hazardous materials.

21.4 When performing work with, on, and around equipment contaminated or suspected as contaminated, assume that the equipment is contaminated until/unless proven otherwise by testing. Exercise care and suitably guard and protect equipment at all times from the start of work until the equipment is either proven by testing as not contaminated or is removed from the project site.

21.5 Where existing equipment is specifically shown on the drawings as containing or filled with electrical insulating fluid ("oil", including transformers marked "OA") and where the equipment is specifically indicated on the drawings as being removed, utilize the services of a qualified testing agency (see the section of these specifications "Testing") to sample and test the oil. Test only for content of PCB's in the oil, unless indicated otherwise. Test a sample from each separate tank/compartment containing oil. Verify exact conditions (including the quantity and arrangement of tanks, compartments, and enclosures, the presence of sampling, drain, or fill valves or plugs, removable covers or access panels, etc.) in field prior to submitting bid. Submit written certified test results to the owner.

21.6 Where equipment is proven by testing as contaminated or is indicated on the drawings as contaminated, perform work as follows:

A. Completely de-energize, disconnect, and make the equipment electrically safe.

B. The owner, at the owner's discretion, shall perform one (1) of the following two (2) options:

1) Completely remove and dispose of the contaminated equipment.

2) Completely "abate" the contaminated equipment by removing hazardous materials from the equipment in complete accordance with all applicable federal, state, and local laws, ordinances, and regulations.

C. Once equipment is abated of hazardous materials by the owner and certified by the

abating vendor as no longer contaminated, the electrical contractor shall then remove the equipment as if the equipment was never contaminated.

21.7 When removing existing luminaires containing ballasts (fluorescent, H.I.D., etc.), consider all ballasts as being contaminated by PCB's, unless ballast factory nameplate specifically indicates that the ballast does not contain PCB's. The electrical contractor shall completely disconnect, remove, and dispose of all ballasts not contaminated by PCB's. For ballasts considered as contaminated by PCB's, remove ballasts from luminaires, cut all ballast wiring leads within 51 mm (2") of the ballasts, and neatly place ballasts in owner furnished drum containers (i.e. 55-gallon). The owner shall dispose of PCB contaminated ballasts in drum containers. For luminaires (with ballasts considered as contaminated by PCB's) where there are signs of ballast rupture or leakage, carefully remove the entire luminaire and turn over to the owner (owner shall dispose of luminaires where PCB leakage is suspected).

END OF SECTION

SECTION 16200 - ELECTRICAL WORK PRACTICES

1. GENERAL PROVISIONS

1.1 The applicable requirements and conditions of specifications section "General Provisions" of specifications division 16100, General Electrical, are hereby made an integral part of this section.

1.2 The work governed by these specifications includes but is not limited to that as defined in specifications section "Scope of Work" of specifications division 16100, General Electrical.

2. INSTALLATION

2.1 Provide all equipment and materials in accordance with the recommendations and instructions of the respective manufacturers. This includes recommendations and instructions for equipment furnished by other trades or the owner and installed or connected by the electrical contractor.

2.2 Perform all work in an approved first class and workmanlike manner and conform to the best practices of the trade and to all requirements of the NEC.

2.3 Protect and preserve all existing, new and proposed raceways, wiring, materials, devices, luminaires, and equipment from corrosion, dirt, paint, building materials, acid, solvents, chemicals, water, ice, tools, overload, freezing, heat, combustion, theft, damage, abrasion, inadvertent removal, improper installation (including where installation has not been completely or properly coordinated), conflicts, interference, vandalism, etc. at all times. Repair or replace all equipment and materials lost or damaged as the result of inadequate protection. Cap and plug open ends of raceways and equipment during construction until wiring is ready to be installed.

2.4 Coordinate with and obtain approval of the owner and architect for all exact locations of all outlets, raceways, materials, and equipment. Fully determine and coordinate all exact routing of raceways. Determine routing before submitting bid and bid accordingly, including allowance to avoid any obstructions which may be encountered. The contractor is solely responsible for routing (any routing of raceways which may be shown on any electrical drawing is for reference only to show the recommended basis of design and does not relieve the contractor of the responsibility for fully determining/coordinating all exact routing, nor does it preclude the use of alternative routing). Prior to purchasing conduit or prior to any installation, submit detailed sketches/drawings of proposed raceway routing, equipment locations, and all other details of installation (submit in Autocad format as part of the shop drawings process at the same time switchgear submittal is submitted). Fully coordinate layouts with all contractors and trades before submitting and identify any areas of potential conflict. Any raceways routed in a location not previously approved shall be removed and reinstalled by the Contractor at the Contractor's own expense (no extra consideration, claims, charges, or compensation will be granted under any circumstance associated with routing of raceways).

2.5 Completely coordinate installation and routing of all wiring, materials, and equipment in the field and with shop drawing information of all trades prior to rough in of wiring or releasing equipment. Completely inspect equipment and materials upon receiving in the field (including equipment received by other trades where installed or connected to by the electrical contractor) and verify exact installation requirements and details (compare to installation and routing as coordinated above) prior to installing, preparing installation,

modifying, or handling in any manner which would restrict the ability to return material or equipment in the event of potential installation complications.

2.6 Cooperate and fully coordinate all work with the work of all other trades, contractors, subcontractors, and the owner, including work as part of other contracts and projects related to and/or in the vicinity of the specified work. Coordinate the locations of pipes, ducts, structure, reinforcement, foundation components, floor/wall/ceiling construction, raceways, branch and distribution panels, luminaires, devices, electrical outlets, air outlets, motor controls, and all other equipment in order to avoid conflicts, interference, or placing services at the wrong locations. Coordinate all demolition, disconnection, removals, relocations, extension, and re-feeding associated with existing equipment and wiring. Coordinate with shop drawings of all trades. Install all wiring and equipment in such a way to maintain clearance and clear access to all equipment requiring access by code or for operating, servicing, maintaining, replacing, examining, etc.. This includes access to electrical equipment and devices as well as mechanical, architectural, and other equipment including, but not limited to, valves, dampers, sensors, meters, gauges, clean-outs, access doors and panels, operating mechanisms, motors, pumps, fans, air handling and other mechanical equipment, etc.. This specifically includes coordinating wall mounted electrical devices and outlets with wall mounted HVAC equipment (including baseboard, radiation, cabinets, etc.).

2.7 Provide all work indicated on the electrical drawings and electrical specifications but involving disciplines of other trades performed by the electrical contractor (or applicable sub-contractors to the electrical contractor), unless specifically indicated otherwise. Perform work in complete accordance with all general construction specifications applicable to the work. This applies to all work including, but not limited to, cutting and patching, excavation, backfill, surface restoration (including paving), concrete, metal fabrication, fire stopping and sealing, painting, etc..

2.8 Properly isolate all materials and equipment against the transmission of vibration or noise to, from, or between any parts of the building.

2.9 The electrical contractor is fully responsible for determining and verifying all exact details of installation. Where installation details or similar information is shown on the drawings or is otherwise forwarded to the contractor (including during construction), the information represents the minimum criteria required and serves as a guide to the contractor but does not relieve the contractor of the responsibility for determining and verifying installation details.

3. GROUNDING

3.1 Completely ground and bond all equipment (specifically including all metallic raceways, cable armor, cladding, and shielding, supports, transformers, cabinets, cable trays, service equipment, and the neutral conductor) in strict and complete accordance with all applicable requirements of the NEC.

3.2 Provide insulated grounding conductors run with all wiring (not applicable to "BX" armored cable [type "AC"] where permitted elsewhere in this specification).

3.3 Install all metallic raceways in such a way to provide a continuous grounding path without the use of the insulated grounding conductor required above. Include all bonding jumpers

and conductors (in addition to the insulated conductor required above) for flexible conduit, loosely jointed raceways, etc.. Provide suitable raceway/conduit fittings for a completely grounded raceway system, including the use of fittings approved and/or listed for grounding, grounding bushings, grounding lock nuts, etc..

3.4 Provide all grounding and bonding materials and connections as per specifications section "Grounding Materials" of specifications division 16300, Electrical Materials.

3.5 Wherever connections to grounding electrodes or electrode systems are required by code, connect and bond to and interconnect the following.

A. Provide new driven (made) grounding rod electrodes, for all services and where equipment is located on or below the second floor of a building.

B. Connect to the domestic cold water piping system and any other metal piping system where required by the NEC (excluding piping prohibited from bonding/grounding by the NEC).

C. Connect to the structural steel and/or metal building frame, where applicable.

D. Connect to all existing grounding electrode systems, where applicable.

3.6 Wherever the following is installed as part of this project (including where installed by other contractors), connect and bond to the grounding electrode system.

A. Ground new metal piping systems where required by the NEC.

B. Ground new structural steel and/or metal building framing.

C. Wherever any new foundation and/or footing is installed with continuous length of 3.0 m (10'0") or more or covering area of 3.3 m^2 (36 sq. ft.) or more, provide concrete-encased electrode(s) as per NEC Article 250.52(A)(3). Provide consisting of not less than 6.0 m (20'0") of #4 AWG bare copper conductor encased in not less than 50 mm (2") of the foundation/footing concrete, except that concrete reinforcement may be substituted for the copper conductor where the size, length, type, and installation of reinforcement complies with NEC Article 250.52(A)(3) for use as a grounding electrode.

D. Ground existing or new computer room style raised floors where within the project scope. In addition, connect to grounding for all panels and electrical equipment serving the raised floor area.

3.7 Where driven (made) grounding rod electrodes are installed, provide grounding resistance not exceeding 1.0 ohm (maximum). Verify proper ground resistance by testing as per the section "Testing" of this specifications division 16100. Where the measured resistance exceeds the maximum value, install additional ground rod(s) at the location and/or set ground rods in suitable listed and NEC approved chemical ground enhancement material in order to obtain proper values, include all costs in bid.

3.8 Detail all grounding on as-built record documents.

3.9 Wherever new wiring or equipment is installed at or near roofs of buildings with lightning protection system(s), bond wiring/equipment to the lightning protection system(s) as per lightning protection codes and standards.

4. WIRING METHODS

4.1 The wiring methods in this section apply to all systems (including power, lighting, emergency, over 600 V, control, telecommunications, data, fire alarm, sound, security, CCTV, and any other system), unless specifically indicated otherwise.

4.2 In finished areas, run all wiring hidden or concealed in/behind ceilings, walls, and floors, include all required cutting and patching. In unfinished areas, wiring may run exposed. Run exposed wiring following building lines.

4.3 Utilize steel rigid metal conduit (RMC) for all wiring unless indicated otherwise. Utilize only steel RMC for all exposed visible exterior raceways, for raceways in wet locations above ground, for exposed visible raceways in damp locations, and for all raceways in NEC hazardous (classified) locations (NEC Chapter 5). Utilize only steel RMC (encase in a 76 mm (3") 20 MPa (3,000 p.s.i.) concrete envelope) for raceways in or below grade that are subject to vehicular traffic (except that reinforced concrete encased PVC RNC or concrete encased steel IMC may be utilized as indicated below). Utilize only steel RMC for all wiring over 600 V (except that PVC RNC may be utilized for underground wiring over 600 V as indicated below). Utilize only steel RMC (with concrete encasement where required by code) where field conditions do not facilitate maintaining NEC required minimum cover for underground PVC RNC. For conduits 53 mm (2") and larger, where concrete encasement is not required above, embed all underground 45 degree or greater conduit bends (field fabricated or factory elbows) in a 155 mm (6") 20 MPa (3,000 p.s.i.) concrete envelope.

4.4 Steel intermediate metal conduit (IMC) may be utilized for all wiring except conditions indicated above as requiring only steel RMC. Steel IMC may be utilized in any condition where PVC RNC is permitted by these specifications. As an alternate to steel RMC, steel IMC (encase in a 76 mm (3") 20 MPa (3,000 p.s.i.) concrete envelope) is permitted under roadways, parking lots, and other areas subject to vehicular traffic. For conduits 53 mm (2") and larger, where concrete encasement is not required above, embed all underground 45 degree or greater conduit bends (field fabricated or factory elbows) in a 155 mm (6") 20 MPa (3,000 p.s.i.) concrete envelope.

4.5 Where permitted by code, schedule 40 or schedule 80 polyvinyl chloride rigid nonmetallic conduit (PVC RNC) may be used underground. Changing PVC RNC thickness (i.e. from schedule 40 to schedule 80 or vice versa) in the middle of any run of PVC RNC is not permitted. Encase all PVC RNC in a 76 mm (3") 20 MPa (3,000 p.s.i.) concrete envelope, unless indicated otherwise. As an alternate to steel RMC, PVC RNC encased in steel reinforced 76 mm (3") 20 MPa (3,000 p.s.i.) concrete envelope is permitted under roadways, parking lots, and other areas subject to vehicular traffic. Provide steel reinforcement consisting of a 12.7 mm (#4) reinforcing rod at each of four (4) "corners" around each conduit in cross section (where encasement includes more than one (1) conduit, rods located between conduits may be "shared"). Provide reinforcing rods continuous for the entire length of the reinforced encasement, join rods where required by overlapping not less than 155 mm (6") and wrapping with suitable reinforcing tie wire. In

unpaved areas not subject to vehicular traffic, schedule 80 PVC RNC may be installed without concrete encasement. In unpaved areas not subject to vehicular traffic, schedule 40 PVC RNC 27 mm (1") and smaller may be installed without concrete encasement. For conduits 41 mm (1.5") and larger, where concrete encasement is not required by these specifications, embed all underground 45 degree or greater conduit bends (field fabricated or factory elbows) in a 155 mm (6") 20 MPa (3,000 p.s.i.) concrete envelope.

4.6 Where runs of PVC RNC protrude exposed and visible above grade or floors, in indoor or outdoor locations, utilize steel RMC for the portions above grade/floor to a minimum depth of 155 mm (6") below finished grade/floor. This requirement does not apply where protruding PVC RNC is completely concealed/hidden within equipment enclosures, walls, or ceilings. Where exposed visible runs of PVC RNC are installed by the contractor (without prior written approval) the contractor shall remove the PVC RNC and install new steel RMC (including cutting and patching to a minimum 155 mm (6") depth and including replacing or reinstalling conductors) at no cost to the owner.

4.7 Where permitted by code, electrical metallic tubing (EMT) may be used for interior feeder and branch wiring in locations not subject to abuse or injury. Utilize steel RMC for conditions indicated above as requiring only steel RMC.

4.8 Utilize flexible conduit for flexible connections to motors, equipment requiring flexibility, equipment subject to vibration (including transformers), and where required for adjustment, in lengths not to exceed 1.8 m (6'0"). Flexible conduit may be utilized for flexible connections to luminaires only where wiring is concealed or located above accessible ceilings (in lengths not to exceed 1.8 m (6'0")). Exposed visible flexible conduit is not permitted for luminaires, except adjustable luminaires. Flexible conduit may be used where existing walls are fished in lengths not to exceed the portion in the wall plus 0.9 m (3'0"). Utilize liquidtight flexible metal conduit (LFMC, "sealtite"), unless indicated otherwise. Utilize only LFMC in damp, wet, and outdoor locations, mechanical rooms, and for NEC hazardous (classified) locations (except as indicated below). Utilize flexible metal conduit (FMC, "greenfield") in dry locations only (except conditions indicated above as requiring only LFMC). Where flexible connections are required in NEC Class I, Division 1 hazardous (classified) locations, utilize only flexible unions listed as suitable for the application. Flexible conduit/fittings of any type are not permitted as a substitute for conduit bends or offsets under any circumstance.

4.9 Where permitted by Code and approved by local authorities having jurisdiction and the owner, armored cable (type "AC", i.e. "BX") and metal clad cable (type "MC") may be used for interior branch wiring concealed in walls/ceilings and hidden above accessible ceilings in dry locations only. Where applicable, comply with NEC Article 518 "Assembly Occupancies". Utilize raceway for all feeder wiring (#4 AWG and larger). Types "AC" and "MC" cables are not permitted in wet, damp, or exterior locations. Types "AC" and "MC" cables are not permitted in exposed visible locations. Type "AC" cable is not permitted for use on circuits exceeding 250 V or for use on DC circuits. Hide cables at panels in electrical rooms and electrical closets as per the section "Branch Panels" of specifications division 16300, Electrical Material. Contact local authorities for approval before submitting bid and include all costs in bid (no extra consideration, claims, charges, or compensation will be granted under any circumstance associated with wiring methods not approved by local authorities).

4.10 Provide surface raceway with integral wiring devices (including receptacles, power outlets, telephone/data outlets, switches, etc.) and/or surface raceway plug-in strips where specifically indicated on the drawings.

4.11 Surface raceway without integral wiring devices is permitted only where all of the following conditions are met or where specifically indicated on the drawings. Surface raceway without integral wiring devices is permitted where physically impossible to run wiring hidden or concealed, where impossible to hide or conceal wiring by cutting, patching, and painting, where approved by code, in dry locations only, and where specifically approved by the owner and architect in writing. Permission to use surface raceway without integral wiring devices is conditional upon there being no cost change to the contract, unless specifically indicated on the written approval.

4.12 Nonmetallic-sheathed cable (types "NM", "NMC", and "NMS", i.e. "romex") is not permitted under any circumstance. Electrical nonmetallic tubing (ENT), liquidtight flexible nonmetallic conduit (types LFNC-A and LFNC-B), high-density polyethylene (HDPE) conduit, type "A" nonmetallic conduit, and type "EB" nonmetallic conduit are not permitted under any circumstance.

4.13 Provide all wiring within air handling plenum spaces in complete accordance with the NEC. Provide wiring methods utilizing metal conduit raceways (as permitted by the specifications) only. Type "MC" cable, where otherwise permitted, may be utilized in plenum ceilings (but not other plenum spaces). Type "AC" cable is not acceptable in plenum ceilings or other plenum spaces.

4.14 Provide all wiring in hazardous (classified) locations or similar locations as defined by the NEC (where applicable) in strict accordance with all applicable requirements of NEC Chapter 5. Utilize wiring methods specified above, installed according to the NEC. Provide a complete installation including all required fittings, all required conduit and cable seals, etc. as indicated in the NEC. The applicable scope of hazardous (classified) locations shall be as indicated on the drawings.

4.15 Provide conduit and cable seals (utilize a NEC hazardous (classified) locations type, even if location is not classified) for all wiring within or passing through walk-in refrigerators/freezers, cold rooms, other refrigerated spaces, and any other location where wiring is exposed to widely different temperatures, in accordance with NEC Article 300.7(A). Consider these areas as wet locations and utilize aluminum RMC or PVC coated steel RMC for all wiring within or passing through these areas.

4.16 Provide all systems wiring (including only fire alarm, telecommunications, data, sound, security, and CCTV, where applicable) in complete accordance with all requirements of other sections of the electrical specifications, except as modified below. Where permitted by Code and approved by local authorities having jurisdiction and the owner, suitable code approved systems type cables (without conduit) may be used for interior systems wiring concealed in walls/ceilings and hidden above accessible ceilings in dry locations only. Contact local authorities for approval before submitting bid and include all costs in bid (no extra consideration, claims, charges, or compensation will be granted under any circumstance associated with wiring methods not approved by local authorities). Systems type cables without conduit are not permitted in wet, damp, or exterior locations. Systems type cables without conduit are not permitted in exposed visible locations. Run wiring in pathways as indicated on the drawings and specifications.

A. Provide wiring as directed, recommended, and approved by the respective system manufacturer/utility company and meeting all minimum requirements of the system manufacturer/utility (including where manufacturer/ utility requirements exceed the requirements of the specifications and the NEC).

B. Provide all cables as multi-conductor style having an overall jacket (of a color other than red; red is reserved for fire alarm) and utilize only cables approved by the NEC for use with the system.

C. Provide all wiring in plenum spaces in complete accordance with the NEC. In dry location plenum ceilings, utilize only plenum rated cables. For damp and wet location plenum ceilings and in all other duct and plenum spaces, run wiring (utilize a non-plenum type suitable for the damp/wet location) in metal conduit. Plenum rated cables may be utilized for other (i.e. non-plenum) applications, but only in dry locations. Plenum cables, even when installed in conduit, are prohibited in damp and wet locations.

D. In damp locations, utilize only cables specifically listed and identified for use in damp or wet locations. Provide all cables in wet locations (including underground and embedded in concrete slabs at or below grade, whether in conduit or direct buried) specifically designed for outdoor and submerged use and specifically listed and identified for use in wet locations.

4.17 Except as indicated otherwise on the drawings, 21 mm (3/4") raceways are the minimum permitted. No raceway smaller than 21 mm (3/4") is permitted under any circumstance (except where specifically approved in writing by the owner and engineer for the individual condition encountered). Where luminaires, devices, or equipment have factory knockouts or hubs smaller than 21 mm (3/4") size (or smaller than conduit sizes specified on the drawings), provide suitable reducing conduit fittings or provide field knockouts at equipment to match conduit size.

4.18 Except as indicated otherwise on the drawings, #12 AWG conductors are the minimum permitted for power and lighting and #14 AWG conductors are the minimum permitted for control and signal systems. #10 AWG conductors are the minimum permitted for outdoor wiring, night lighting circuit wiring, and emergency power and lighting wiring. #10 AWG conductors are the minimum permitted where circuits exceed 23 m (75'0") for 120/208/240 V circuits or exceed 46 m (150'0") for 277/480 V circuits, measured to the center of the load.

4.19 Provide a separate neutral conductor with each branch circuit where a neutral is required or indicated on the drawings. Multi-wire branch circuits with a shared common neutral are not permitted, unless specifically indicated otherwise on the drawings. Utilize multi-wire branch circuits with a shared common neutral conductor for lighting controlled by "dual switching" where the lighting is connected to two (2) circuits.

4.20 Multiple branch circuits may be installed in the same raceway (including surface raceways) where permitted by code and provided all of the following conditions (A through D below) are met.

A. Apply appropriate NEC de-rating factors and adjust conductor sizes accordingly. Wiring sizes indicated on the drawings are based on each circuit run in an individual

raceway (and are not adjusted for de-rating factors), except where multiple branch circuits in a common raceway are specifically indicated on the drawings (wiring is adjusted for applicable de-rating factors in this case, but only for the specific wiring combination shown on the drawings).

B. Provide no conductor (after de-rating adjustment) exceeding #10 AWG, except grounding conductors as provided below (or as otherwise specifically approved in writing by the engineer).

C. Common equipment grounding conductors are permitted in lieu of individual equipment grounding conductors for each individual circuit. Provide minimum single equipment grounding conductor size two (2) standard wire sizes larger than the size as determined in accordance with the NEC. Provide isolated grounding conductors (where required) individually for each circuit and in addition to common equipment grounding conductors.

D. Provide raceway fill (after de-rating adjustment) not exceeding 30% (provide maximum number of conductors permitted not exceeding 75% of the maximum number permitted by Code [i.e. refer to NEC Chapter 9 and Annex C] to allow for future wiring). Adjust minimum conduit size to maintain 30% maximum fill.

4.21 Minimum raceway sizes indicated in the specifications and on the drawings are applicable to all conduit types specified, except schedule 80 PVC RNC (unless the drawings specifically indicate schedule 80 PVC RNC). Where schedule 80 PVC RNC is utilized and the specified conduit size is 63 mm (2.5") and smaller, increase conduit to the next higher trade size. Where schedule 80 PVC RNC is proposed and the specified conduit size is 78 mm (3") and larger, submit raceway fill calculations; where raceway fill with the specified conduit size exceeds 40%, increase conduit to the next higher trade size.

5. WIRING INSTALLATION

5.1 Securely support and fasten all raceways, cables, outlets, boxes, equipment, etc. in place as per the NEC. Support at intervals as per the NEC, but in no case exceeding 3.0 m (10'0"). Refer to the section of this specification "Fastenings, Supports, and Hangers" for information.

5.2 Where any run of wiring passes vertically through more than one (1) floor level (including where installed in open vertical chases), support at every floor level. For conduits 63 mm (2.5") and larger, utilize only suitable pipe riser clamps (B-Line #B3373 series or approved equal), suitable wall bracket offset pipe clamps (NPHC-National Pipe Hanger Corp. figure #430 series or approved equal), or engineer approved heavy duty steel brackets (fabricated of not less than 6.5 mm (1/4") thick steel and of type, design, and arrangement suitable for the specific application and weights involved) for these floor level supports. Conduit clamps and strut type supports are not acceptable for this application. Equipment as manufactured by B-Line, Erico, and NPHC (or approved equal) shall be considered.

5.3 Make all changes in direction of 27 mm (1") and larger conduits with standard elbows or case metal fittings. Fabricate field-made bends and offsets in conduit with suitable hickey/conduit-bending machine. Make conduit bends of the long radius type without kinks, flattening or crushing. Do not install crushed or deformed raceways. Avoid trapped raceways in damp and wet locations. Exercise care to prevent the accumulation of plaster,

dirt, or trash in raceways, boxes, fittings and equipment during the course of construction. Entirely free clogged or obstructed raceways or replace raceways

5.4 Provide raceway ends cut squarely and reamed. Provide raceway installation (including pull boxes as applicable) so there is no more than a total of 360 degrees of bends in any run of raceway. Provide pull boxes at intervals not greater than every 30 m (100'0"), unless otherwise indicated on drawings.

5.5 Maintain a separation of not less than 155 mm (6") between all raceways and hot water lines, steam lines, and any other surface with temperature exceeding 104 degrees F (40 degrees C), whenever possible. When not possible to maintain the 155 mm (6") separation, provide insulation pipe covering on the electrical raceways.

5.6 Provide a suitable insulating or grounding type (as applicable) bushing on each conduit terminating in a pressed steel box and for each conduit stub. Bushing is not required where conduit terminates in a suitable conduit connector/termination fitting which includes an integral bushing or which provides smoothly rounded surface suitable and approved for use without a bushing.

5.7 Wherever raceways pass across structure expansion joints, provide suitable conduit expansion fittings. Where expansion fittings are not listed for grounding, provide external flexible copper grounding strap. Wherever expansion fittings are installed, provide a suitable junction box located not farther than 7.6 m (25'0") from the expansion fitting location. Coil suitable slack conductors in this junction box to allow functioning of expansion fittings. For continuous runs of PVC RNC exceeding 27 m (90'0"), provide expansion fittings at intervals not exceeding 15 m (50'0") to compensate for linear thermal expansion and contraction.

5.8 Where metal raceway is installed in contact with or entering earth or concrete in outdoor, wet, or damp locations, coat raceway with engineer approved coal tar or epoxy based corrosion resistant coating (3M, Benjamin Moore, Carboline, or approved equal).

5.9 Running threads are not permitted.

5.10 Do not run wiring horizontally across floors or the ground, to avoid tripping hazards and facilitate cleaning floors.

5.11 Horizontal runs of raceway at rooftops are not permitted (to facilitate future roofing repairs/replacement) except where specifically approved in writing by the architect and owner. Horizontal runs may not exceed 2.4 m (8'0") length. Do not install any wiring or electrical equipment of any type (specifically including disconnecting means and receptacles) within 4.5 m (15'0") of any edge of any roof under any circumstance, to avoid tripping and fall hazards. Equipment and wiring is only permitted within 4.5 m (15'0") of any edge of any roof where necessary to serve utilization equipment within the space and only where specifically approved in writing by the engineer and architect (where approved suitable protective means are included to prevent fall hazards). Support raceways at roofs in a manner to avoid harming, impacting, or compromising the roofing weatherproof integrity (fully coordinate requirement with roofing contractor/supplier [where present], architect, and owner). Where wiring is installed atop roofing material, utilize only pre-cast concrete paving units measuring not less than 12" x 12" x 2" (300 mm x 300 mm x 51 mm) laid on the roof and bonded to the roof using suitable roofing adhesive. Running rooftop wiring on wood blocks or bricks is not permitted under any circumstance.

5.12 In all kitchens, food preparation, and similar areas, run wiring concealed as much as possible. Where necessary to run wiring exposed, maintain space between raceways and building surfaces and run raceways *vertically only* in such a way to facilitate cleaning walls, ceilings, and floors and to avoid accumulation of foreign materials.

5.13 Install wiring in such a manner to avoid infiltrating water into the wiring system (during or after construction). Install wiring in such a manner so any water which does infiltrate cannot become trapped or accumulate and cannot drain into electrical or other equipment.

5.14 Install exposed wiring (including visible wiring and wiring in accessible ceiling spaces or other accessible locations) parallel or perpendicular to walls, structural members, or intersections of vertical planes and floors or ceilings.

5.15 Install concealed wiring (except as provided above for wiring in accessible spaces) as straight and direct as possible. Detail routing of all concealed wiring on record (as-built) documents.

5.16 Space raceways embedded in concrete slabs, walls, beams, etc. or run underground not closer than 76 mm (3") between outsides of raceways and install to avoid changing locations of reinforcement. Except when plans of raceways are approved by the engineer, provide embedded raceways, other than those merely passing through, not larger in outside diameter than one-third the thickness of the slab, wall, beam, etc. in which embedded.

5.17 Embedded raceways are not permitted to cross, except where the 76 mm (3") spacing and one-third thickness provisions above are maintained or exceeded.

5.18 In building exterior walls and roofs, do not install any wiring, other than that merely passing through, in veneer cavity or other interstitial spaces of the building envelope.

5.19 Provide all splices only in suitable code-sized junction or outlet boxes. Splices are not permitted in any type of conduit body under any circumstance.

5.20 Do not install any wires in raceways until all raceway work is completed and closed in such a manner as to prevent the possibility of water or other foreign matter entering raceways.

5.21 Wherever empty or spare raceways are installed, provide suitable pull wires with identification tags securely attached to each end. Where empty or spare raceways do not terminate in boxes or enclosures, provide suitable conduit caps. Utilize only conduit fitting type caps appropriate for the conduit involved. Rubber and plastic conduit plugs, duct sealing compounds, and tape are not acceptable.

6. FASTENERS, SUPPORTS, AND HANGERS

6.1 Provide all fastenings, supports, hangers, clamps, and anchors of the type made for the specific purpose for which they are used.

A. Utilize wood screws for fastening to wood.
B. Utilize toggle bolts or bolt fastenings for fastening to hollow tile, terra cotta, hollow masonry units, lath, and similar construction.
C. Utilize machine screws/bolts with nuts for fastening to structural steel.

D. Utilize metallic expansion shield anchors and machine screws/bolts for fastening to concrete, brick, and solid masonry. Wooden plugs with screws and plastic expansion shield anchors are not acceptable.
E. Threaded studs driven in by a powder charge and provided with washers and nuts may be used in lieu of expansion anchors, machine screws, and wood screws under the applications indicated above.
F. Utilize engineer approved adhesive fastening on roofing areas (mechanical fasteners are not be permitted to be driven into roofing surfaces).
G. Threaded C-clamps are not permitted.
H. Additional acceptable supports for a single 21 mm (3/4") EMT only include common nails for wood, spring-tension clamps for steel and nail-type nylon anchors for masonry.
I. Additional acceptable supports for not more than two (2) cables (where cable wiring methods are permitted elsewhere in this specification) only include nails for wood, spring-tension clamps for steel, and nail-type nylon anchors for masonry. A single cable only may be secured directly to wood with NEC approved cable staples.

6.2 To prevent swaying, vibrating and/or sagging, rigidly and firmly install raceway and cable (where cable wiring methods are permitted elsewhere in this specification).

A. Support with malleable or wrought steel clamps, hangers, or with fabricated strut type supports (steel only, aluminum is not acceptable unless specifically indicated on the drawings). Provide strut type supports as B-Line, Kindorf, Power-Strut, or Unistrut (or approved equal).
B. Stamped metal one-hole and two-hole straps are permitted to secure EMT and cable wiring methods permitted by the specifications in exposed and concealed dry indoor locations not subject to abuse or injury only.
C. Stamped metal wrap around "mineralax" type hangers are permitted to secure EMT and cable wiring methods permitted by the specifications in hidden and concealed dry indoor locations not subject to abuse or injury only. Stamped metal wrap around type hangers are not permitted for visible exposed wiring.
D. Additional manufactured fastening systems specifically designed for the purpose shall be considered to secure cable wiring methods permitted by the specifications, but only where submitted for review and approval before commencing work.
E. Do not weld raceways, clamps, hangers, or straps to steel structure.
F. Wire (including ceiling support wires), perforated pipe straps, plastic ties, "J" hooks, and bridle rings are not acceptable.

6.3 Provide all supports and fasteners of the following materials, unless indicated otherwise.

A. Utilize stainless steel for all applications, unless indicated otherwise. Utilize stainless steel only when underground or in contact with earth or floors in outdoor areas, mechanical rooms, kitchens, and other areas subject to the possible presence of water on the floor/ground.
B. Steel protected by hot-dip or mechanical galvanizing after fabrication may be utilized for all conditions except conditions indicated above as requiring only stainless steel. Clean areas where galvanizing is cut or damaged and touch-up with suitable zinc dust/zinc oxide paint.
C. Steel protected by pre-galvanizing before fabrication, epoxy coating, zinc electrolytic plating, or other engineer approved corrosion resistant coating may be utilized for interior locations not subject to abuse or injury.

D. Other materials providing equivalent or superior strength and corrosion resistance to the above shall be considered.
E. Supports and fasteners without corrosion protection, protected only by painting, or protected only by oil coating are not acceptable under any circumstances.
F. For electrical fasteners (at conductors and all current-carrying parts), utilize only materials and types approved by the NEC and listed for the application.

6.4 Provide all fastening, supports, wall brackets, ceiling trapeze, and hangers for the installation of all equipment and wiring. Install all fastenings, supports and hangers in such a way and at such intervals as per NEC or otherwise required to support the equipment. The electrical contractor is responsible for verifying that supports are adequate for the load supported, based upon weight, stresses which may be applied to the support (including when installing equipment, pulling wiring, physical impacts to equipment, and seismic/earthquake loads as per IBC Section 1613), vibration, etc. Submit calculations for any supports where requested by the engineer.

6.5 In new concrete structure, engineer approved cast-in-place type inserts (furnished and installed by the electrical contractor and coordinated with and under the direct supervision of the general contractor) may be utilized in concealed locations, unfinished spaces, and other locations where approved by the architect and owner. Inserts may be of the spot or continuous types. Continuous type may be used to directly support raceways.

6.6 For all telephone and equipment backboards indicated on the drawings and wherever plywood backboards are installed to support and/or mount electrical equipment, utilize only fire resistant plywood.

6.7 Where the contractor installs fasteners or supports not meeting specified requirements (without prior written approval) the contractor shall remove the fasteners and supports and install new fasteners and supports as specified at no cost to the owner.

7. CHASES, RECESSES, AND OPENINGS

7.1 Provide, including all excavation, cutting, patching, fire stopping, sealing, backfill, surface restoration, and painting, all required openings, chases, and recesses in the construction for all work.

7.2 Where openings are required in new or modified structure, furnish the exact location, size, and other necessary information to the contractor installing or modifying the structure in ample time to have them incorporated during construction as approved by the architect and engineer. If the electrical contractor fails to comply with these information requirements, then the electrical contractor shall perform the necessary cutting and patching at his own expense under the direct supervision of the general contractor.

7.3 Where openings in masonry are required, make by coring only.

7.4 Locate and provide all openings (including openings for junction and outlet boxes and luminaires) in such a manner to maintain any required fire/smoke rating, waterproof, and sound transmission integrity in accordance with all applicable codes and standards (including, but not limited to IBC/BOCA, NFPA, and UL). Where boxes are located in opposite sides of fire/smoke/sound rated walls, maintain minimum spacing between boxes

as per NEC. The general contractor shall provide fire/smoke rated enclosures around luminaires and boxes where required to comply with fire/smoke ratings.

8. CUTTING, PATCHING, FIRE STOPPING, AND PAINTING

8.1 Perform all required excavation, cutting, patching, fire stopping, sealing, backfill, surface restoration, and painting associated with the electrical installation. Perform in accordance with general construction specifications and as indicated elsewhere in this specification. Coordinate all requirements with the general contractor. This includes cutting and patching associated with suspended ceiling tiles and grid.

8.2 Completely restore (including painting where applicable) all surfaces to match existing condition as directed and approved by the owner, architect, and engineer.

8.3 Completely seal and fire stop all penetrations of all fire and/or smoke rated walls, floors, ceilings and any other construction (including all construction required to be rated by any code) to a rating matching or exceeding the fire rating of the construction. Refer to architectural drawings and specifications for information on fire ratings of building construction and include all costs in bid. Provide the complete installation (including fire stopping methods and materials) complying with all applicable fire rating codes and standards (including the NEC, NFPA, IBC/BOCA, and UL (including the UL "Fire Resistance Directory").

8.4 Completely seal and weatherproof all penetrations of exterior, at or below grade, and wet location walls and floors and roof penetrations.

8.5 Paint all exposed raceways, boxes, enclosures, etc. as directed by the owner and architect.

8.6 Provide baked enamel painted finish for all equipment and materials as directed by the owner and architect. Wherever finish colors are indicated on the drawings (including symbol list and luminaire schedule) as being selected by the architect ("as per architect", etc.), include costs in bid to utilize any of the available standard and/or optional colors listed in manufacturers' catalogs (excluding any colors identified in manufacturers' catalogs as "custom" or "premium").

8.7 Touch up damages to prime and/or finished paint coats on equipment. This includes touching-up stainless steel surfaces to avoid superficial surface rust (i.e. at cut surfaces and welds).

9. SLEEVES

9.1 Provide sleeves in all construction. Provide sleeves of minimum 0.85 mm (22 ga.) galvanized steel, sized for passing raceway/cable, and of the proper design for sealing and flashing around the sleeves where required. Locate and set sleeves extending approximately 51 mm (2") above floor in concealed locations, unfinished rooms, and mechanical spaces. Locate and set all sleeves flush with finished surfaces in finished areas unless otherwise directed by the owner and architect.

9.2 Seal the space between the raceway/cable and sleeve and between the sleeve and structure

in an engineer and code approved manner. Seal and fire-stop all penetrations to a fire rating not less than the wall, ceiling, floor, or member penetrated. Completely seal and waterproof all penetrations of exterior walls, roofs, mechanical room floors, or any other area subject to weather or water.

10. FLASHING AND ACCESS PANELS

10.1 Where a general contractor is present, base flashing is by the general contractor, otherwise base flashing is by the electrical contractor. Counter flashing (provide of 0.47 mm (28 ga.) copper) is by the electrical contractor under all circumstances.

10.2 Provide access panels for all items requiring accessibility for operation and maintenance or where required by code. Provide access panels of not less than 1.6 mm (16 ga.) steel frame and not less than 1.9 mm (14 ga.) steel panel, with tamper-proof fasteners, and compatible with the type of construction in which they are installed. Where installed in fire rated walls or ceilings, provide access panels with fire rating matching or exceeding the fire rating of the wall/ceiling involved.

10.3 Where a general contractor is present, the electrical contractor shall furnish all access panels and the general contractor shall install access panels under the direction of the electrical contractor.

11. LOCATIONS AND MOUNTING HEIGHTS

11.1 The approximate locations of luminaires, pipes, switches, radiation, receptacles, outlets and other equipment and materials are indicated on the drawings. Provide actual locations and mounting heights as determined by, confirmed with, and approved by the owner and architect during field construction (prior to rough-in). Where equipment or devices are installed without prior approval/confirmation or without prior written notification (see below) and the location or mounting height is not acceptable to the owner and architect, relocate the equipment and all associated wiring as directed by the owner and architect at no cost to the owner.

11.2 Provide mounting heights complying with all applicable federal, state, and local disabled ("handicapped") access codes, standards, and requirements, including the Americans with Disabilities Act (ADA).

11.3 Provide mounting heights for all equipment as follows. Utilize standard mounting heights indicated below for all equipment, unless indicated otherwise on the drawings or otherwise directed by the owner and architect. Where installation conditions and/or obstructions make it impossible to install equipment at the standard height, the mounting height may be adjusted to suit conditions, provided the mounting height falls within the listed maximum and minimum heights. Notify the architect and engineer in writing of all conditions where deviating from standard mounting heights. Provide mounting heights not greater than the maximum mounting height and not less than the minimum mounting height under any circumstance, unless specifically approved in writing by the owner, architect, and engineer.

11.4 All mounting heights listed below are above finished floor, unless indicated otherwise. Mounting heights listed as "to bottom" are measured to the lowest operable part of the equipment or the lowest visual indicating device on the equipment. Mounting heights listed as "to top" are measured to the highest operable part of the equipment or the highest

visual indicating device on the equipment.

	Mounting Heights		
	Standard	Minimum	Maximum
Control Devices			
Wall Switches & lighting controls	46" (1.17m) to ctr.	15" (0.38m) to bot.	48" (1.22m) to top
Thermostats & other controls	46" (1.17m) to ctr.	15" (0.38m) to bot.	48" (1.22m) to top
Receptacles and Outlets			
Receptacles, tele/data, & similar *	18" (0.46m) to ctr.	15" (0.38m) to bot.	48" (1.22m) to top
Wall mounted telephones	46" (1.17m) to top	27" (0.69m) to bot.	48" (1.22m) to top
Electrical Equipment			
Safety switches **	See max./min.	15" (0.38m) to bot.	48" (1.22m) to top
Enclosed circuit breakers **	See max./min.	15" (0.38m) to bot.	48" (1.22m) to top
Devices with fuses/breakers **	See max./min.	15" (0.38m) to bot.	48" (1.22m) to top
Contactors **	See max./min.	15" (0.38m) to bot.	48" (1.22m) to top
Transfer Switches **	See max./min.	15" (0.38m) to bot.	48" (1.22m) to top
Time clocks, individual **	See max./min.	15" (0.38m) to bot.	48" (1.22m) to top
Annunciators and displays	46" (1.17m) to ctr.	15" (0.38m) to bot.	48" (1.22m) to top
Equip. indicated with (**) where group mounted	15" (0.38m) to 48" (1.22m)	None	78" (1.98m) to top
Equip. indicated with (**) where too large to mount at above heights	15" (0.38m) to 48" (1.22m)	None	78" (1.98m) to top
Branch panels	15" (0.38m) to 48" (1.22m)	None	78" (1.98m) to top
Wall mounted distribution panels	15" (0.38m) to 48" (1.22m)	None	78" (1.98m) to top
Controllers & grouped controls	15" (0.38m) to 48" (1.22m)	None	78" (1.98m) to top
Individual meter sockets ***	48" (1.22m) to ctr.	36" (0.92m) to ctr.	60" (1.52m) to ctr.
Meter centers ***		Contact engineer	
Fire Alarm Equipment			
Fire alarm controls	15" (0.38m) to 48" (1.22m)	None	78" (1.98m) to top
Pull stations	48" (1.22m) to top	42" (1.07m) to bot.	48" (1.22m) to top
Horns/speakers/strobes/bells ****	80" (2.03m) to bot.	80" (2.03m) to bot.	96" (2.43m) to bot.
All equipment mounted above counters	*****	15" (0.38m) to bot.	44" (1.17m) to top
Other Equipment			
Other equipment mounted on standard electrical outlet boxes	46" (1.17m) to ctr.	15" (0.38m) to bot.	48" (1.22m) to top

Contact the engineer for any equipment not listed or similar to equipment above.

* Specifically coordinate with any wall-mounted radiation, if present

** Applies where equipment is mounted individually, see below for group mounted equipment.

*** Provide metering equipment mounting heights conforming to utility company requirements, where applicable, regardless of mounting heights indicated above.

**** For ceilings lower than 90" (2.29m), mount fire alarm signaling devices 6" (0.15m) below the ceiling. Fire alarm signaling devices may be ceiling mounted if mounted on the lowest portion of the ceiling, if mounted not higher than 9.14 m (30'0") above the lowest floor level in the room and if located and spaced in accordance with NFPA requirements.

***** Standard mounting height for above counter equipment is 6" (0.16m) above back splash or 8" (0.20m) above counter where no back splash is present, but not higher than the maximum shown above.

11.5 Where any equipment or device protrudes more than 100 mm (4") from the finished wall surface, mount at height conforming with the ADA and in accordance with the following. Contact the engineer where maximum and minimum heights listed above conflict with mounting requirements summarized below.

A. Mount so the bottom of equipment/device is 0.68 m (2'3") AFF or less.

B. Mount so the bottom of equipment/device is 2.0 m (6'8") AFF or greater.

C. Projecting equipment/devices are permitted mounted with the bottom between 0.68 m (2'3") and 2.0 m (6'8") AFF where protected with a suitable warning barrier in accordance with ADA requirements.

D. Projecting equipment/devices are permitted mounted with the bottom between 0.68 m (2'3") and 2.0 m (6'8") AFF without warning barrier protection only where specifically approved in writing by the engineer.

12. ELECTRIC SERVICE

12.1 Perform all electrical service work complying with applicable electric utility company standards and requirements, including metering equipment locations, equipment specifications, service/meter applications, inspections, notification, scheduling, and service pole/manhole.

12.2 Utility service-related work shown on the drawings is approximate as a guide to pricing only and is not fully coordinated with respective utility companies. Submit to utility companies for approval all required service/meter application forms and shop drawings on all service-related equipment and materials (service drop, lateral, and entrance conductors and raceways, metering equipment of any kind, any equipment containing a service disconnect or service overcurrent device, any equipment on the line side of a service disconnect, pole risers, transformer pads, transformer connections, any equipment subject to utility company standards/regulations, and any other equipment requested by utilities). Fully coordinate all service-related work in detail with utility companies, and obtain written approval (specifically including formal response to service/meter application) from utility companies, before releasing equipment and before associated rough-in of work. The electrical contractor is solely responsible to fully coordinate and verify service requirements with utility companies (include all costs in bid). No consideration, claims, charges, or compensation will be granted under any circumstance associated with failure to fully coordinate with or obtain full approvals from utility companies.

12.3 Reference single line diagram for description of the proposed electrical system.

12.4 Where pole risers are indicated on the drawings, provide a complete riser in accordance with all applicable utility company requirements. Verify exact riser requirements with utility company prior to submitting bid (include all costs in bid). Provide riser including all ancillary equipment as directed by the utility company, including (but not limited to) raceways stubbed and/or run up pole, molding, grounding, suitable slack conductors, location of riser around circumference of pole, etc..

12.5 Provide protective bollards for all pad mounted outdoor equipment. Provide quantity and

location as per utility company standards (for both utility and customer owned equipment) unless otherwise indicated on the drawings. Provide consisting of not smaller than 102 mm (4") steel RMC filled with concrete, protruding at least 1.2 m (4'0") above finished grade, set in not less than 0.3 m (1'0") diameter x 0.9 m (3'0") deep concrete base, and in no case less than the minimum construction required by utility company standards. Provide bollards even if not shown on electrical drawings.

13. UTILIZATION EQUIPMENT CONNECTIONS

13.1 Provide complete power wiring and final connections for utilization equipment as indicated on the drawings. This includes, but is not limited to, all mechanical, kitchen, manufacturing, computer, medical, office, copier, fixed, and portable equipment and apparatus. Coordinate all requirements with the contractor supplying the equipment (the supplying contractor).

13.2 Provide connections complete and including power wiring from the electrical contractor provided local disconnecting means to each piece of equipment. If required, pass power wiring through supplying contractor furnished control equipment (including thermostats, relays, timers, integrated controllers, starters, contactors, VFD's, etc.). Provide a single point connection or multiple-point connections (by separating one larger circuit into smaller circuits at controller and/or equipment) as applicable (include all costs in bid). The electrical contractor is responsible for taking deliveries of all control equipment (which power wiring passes through) from the supplying contractor and for mounting and passing power wiring through this control equipment. Locate control equipment as indicated on mechanical or other trades documents or as otherwise coordinated with and approved by the owner, architect, mechanical engineer, and the supplying contractor.

13.3 All control wiring and associated raceway is by the supplying contractor (regardless of voltage), unless specifically indicated on the drawings. All central/common control panels are by the supplying contractor (power wiring is by the electrical contractor), unless specifically indicated on the drawings.

13.4 Provide safety switches as local disconnecting means at all equipment. Provide switches regardless of whether shown on the drawings or not. Provide switches regardless of whether or not the equipment includes integral unit switches or circuit breakers. Provide outdoor switches as NEMA-3R and indoor switches as NEMA-1.

13.5 For all equipment rated 120 V or 277 V and 20 A or less, provide either direct connection, including thermal overload switch where disconnecting means is required, or suitable receptacle where equipment is supplied with cord and plug (combination of plug and receptacle serves as disconnecting means), include all costs in bid.

13.6 Prior to rough in of raceway or purchasing any associated electrical equipment, obtain shop drawings from the supplying contractor and verify all requirements. The electrical contractor is fully responsible for contacting and obtaining copies of approved shop drawings from the supplying contractor. This includes fully coordinating the locations of all equipment and wiring in/serving elevator shafts, pits, and machine rooms.

13.7 Where equipment is served by variable frequency drives (VFD's), other solid-state controllers, or other special starters or controllers, wiring indicated on the drawings is as a guide to pricing only. Prior to rough in of raceway or purchasing associated electrical

equipment, verify all requirements in writing with the supplying contractor. Provide exact circuit breaker trip amperes (or fuse amperes, where applicable) for circuits feeding this equipment as coordinated with and directed and approved by the manufacturer, include all costs in bid. Where the required circuit breaker/fuse amperes exceed the ampacity of the specified wiring, notify the engineer in writing. Provide all safety switches connected on the load side of VFD's with auxiliary contacts and interconnect (including providing all required wiring in separate 21 mm (3/4") raceway from power wiring) with VFD controls (to prevent and stop operating VFD with load disconnected). Provide all power wiring on the load side of any VFD as a dedicated circuit (from individual VFD to motor served) with no other circuit or wiring (of any kind) in the same raceway.

13.8 Where heat trace, control power transformers and control power supplies (rated 500 VA and less), electric alarm bells, plug-in condensate pumps, ultraviolet germicidal lamps in HVAC equipment, electrically operated security devices, door hardware, dampers (including smoke and fire dampers), and valves (including sinks/toilets/urinals), switchgear/switchboard strip/space heaters, etc. are specified on mechanical, plumbing, fire protection, electrical, or architectural drawings or specifications, provide appropriate wiring and power connections (whether shown on electrical drawings or not). Verify and coordinate voltage and wattage/amperes in field and provide wiring accordingly. Obtain power from a suitable nearby branch circuit. Include all disconnecting means switches, junction boxes, receptacles, and other equipment as per code or manufacturer recommendations. Provide ground fault protection (utilizing protective devices complying with the NEC) for all heat tracing.

13.9 For ductless split ("mini") style HVAC equipment the electrical contractor shall coordinate in detail with the supplying mechanical contractor before submitting bid to ensure that the equipment is compatible with power wiring shown on the electrical drawings. The supplying contractor shall furnish only equipment which is capable of separate and independent power supply to indoor and outdoor ductless split units (powering indoor unit from outdoor unit is not acceptable, unless specifically indicated on the electrical drawings). The supplying contractor shall furnish only equipment which is arranged so the incoming power wiring is energized all of the time and so the incoming power wiring is not used to control any of the equipment involved. All control wiring between indoor and outdoor units (and branch controllers, where applicable) is by the supplying contractor (see specifications section 13.3 above). Where ductless split equipment is supplied which is normally arranged to control one unit from another by directly switching power wiring, the supplying contractor shall include any necessary suitable relays (and associated wiring and modifications) to accommodate independent power supply. The electrical contractor is responsible for ensuring that this is coordinated in advance and that the ductless split style HVAC equipment, control wiring, and relaying is furnished by the supplying contractor accordingly. No extra consideration, claims, charges, or compensation will be granted under any circumstance associated with coordination of interconnection of ductless split style HVAC equipment.

14. DEMOLITION, REMOVAL, RELOCATION, AND RE-FEEDING

14.1 Disconnect, remove, relocate, and/or re-feed existing wiring and electrical equipment as indicated on the drawings (including, but not limited to, as indicated in electrical notes on the drawings) and otherwise provided in contract documents. Assume that all demolition and new construction requires disconnecting, removing, relocating, and re-feeding unless

verified otherwise in the field. No consideration, claims, charges, or compensation will be granted for any alleged misunderstanding of the scope of disconnecting, removing, relocating, and re-feeding or as a result of failure to verify existing conditions.

14.2 Fully verify all requirements associated in any way with demolition, removals, relocations, and re-feeding and include all costs in bid. Visit site prior to submitting bid and investigate and verify all existing conditions (including verifying conditions above all accessible "drop" ceilings and in accessible chases). Completely remove from the site and properly dispose of all equipment and materials removed.

14.3 Prior to commencing any removals, completely verify all conditions and exact requirements related to re-feeding, maintaining, or affecting service to existing electrical equipment, devices, and wiring and mechanical, architectural, and other equipment and system in the field during construction. Where equipment or wiring is removed which is required to re-feed equipment, maintain service, or effects systems to remain, replace or reinstall the equipment and wiring. No extra consideration, claims, charges, or compensation will be granted to re-feed, reinstall, replace, reconfigure, etc. wiring and equipment where removed without first verifying all conditions.

14.4 Wherever electrical equipment and wiring is removed from visible finished surfaces, patch and restore the surface to the original condition matching existing adjacent surfaces. This includes all required painting, filling all openings (including channels and filling holes left from supports), etc..

14.5 Where existing ceilings are removed and reinstalled (either partly or entirely), remove all existing electrical equipment (including lighting fixtures, fire alarm devices [including, but not limited to, smoke and heat detectors, signaling devices, indicators, etc.], security/CCTV cameras, motion detectors, speakers, and all other electrical devices, equipment, and apparatus) from the ceiling grid and ceiling tiles. Leave in place at the ceiling and temporarily support (in a code approved and local authorities having jurisdiction approved manner) to facilitate ceiling removal. Once ceiling is reinstalled, permanently reinstall all electrical equipment in the ceiling. Where new equipment is shown on the drawings, completely disconnect and remove existing equipment (being replaced) and all associated wiring and provide all new equipment and associated wiring as shown on the drawings. Ceilings may be left open for a long period of time (i.e. there may be several months or more between the time of removal and the time of reinstalling ceilings). When ceilings are not in place, maintain (as operational) all fire alarm devices and equipment and normal and emergency lighting (temporarily install fire alarm devices, supported from structure and provide temporary lighting or temporarily support existing lighting from structure as applicable). When ceilings are not in place, safely secure everything which is exposed by the absence of ceilings (new and existing) and keep all areas clean when occupied. This ceiling work is not shown on electrical plans (see architectural drawings and ceiling plans and other trades drawings for information). This ceiling work applies regardless of the party removing the ceiling and regardless of whether or not ceiling removal is shown on drawings. Coordinate with all contractors and trades to confirm the extent of ceiling work and include all costs in bid. This ceiling work also applies where any contractor chooses to install new ceiling in lieu of reinstalling the existing ceiling.

14.6 Where existing ceilings are removed and new ceilings are installed (either partly or entirely), remove all existing electrical equipment (including lighting fixtures, fire alarm devices [including, but not limited to, smoke and heat detectors, signaling devices,

indicators, etc.], security/CCTV cameras, motion detectors, speakers, and all other electrical devices, equipment, and apparatus) from the ceiling grid and ceiling tiles. Leave in place at the ceiling and temporarily support (in a code approved and local authorities having jurisdiction approved manner) to facilitate ceiling removal. Once new ceiling is installed, permanently reinstall all electrical equipment in the ceiling. Where new equipment is shown on the drawings, completely disconnect and remove existing equipment (being replaced) and all associated wiring and provide all new equipment and associated wiring as shown on the drawings. Ceilings may be left open for a long period of time (i.e. there may be several months or more between the time of removal and the time of installing new ceilings). When ceilings are not in place, maintain (as operational) all fire alarm devices and equipment and normal and emergency lighting (temporarily install fire alarm devices, supported from structure and provide temporary lighting or temporarily support new or existing lighting from structure as applicable). When ceilings are not in place, safely secure everything which is exposed by the absence of ceilings (new and existing) and keep all areas clean when occupied. This ceiling work is not shown on electrical plans (see architectural drawings and ceiling plans for information).

14.7 Where electrical work involves removal and reinstallation of existing ceilings, removal and relocation is the responsibility of the electrical contractor. As an alternative (at the electrical contractor's option) to reinstalling ceilings removed to facilitate electrical work, the electrical contractor may install a new ceiling of a type matching the existing ceiling provided there is no cost change to the contract (wherever new ceiling involves additional cost to the contract, new ceiling is not acceptable).

15. EXCAVATION, BACK-FILLING, AND RESTORATION

15.1 Perform all required excavation, cutting, patching, backfill, surface restoration, and painting associated with the electrical installation, perform in accordance with general construction specifications. Coordinate all requirements with the general contractor. Refer to the section of this specification "Cutting, Patching, Fire-Stopping, and Painting" for additional information.

15.2 Install all underground wiring to maintain a minimum cover of 0.8 m (2'7") to top of raceways. Where field obstructions do not facilitate the above minimum cover, minimum cover as indicated in NEC Article 300.5 is permitted.

15.3 Perform all excavation and work in and associated with excavation in accordance with all applicable safety codes, standards, regulations, and requirements (refer to specifications section "Safety" of specifications division 16100, General Electrical).

15.4 Completely restore all surfaces to a condition matching or exceeding the original condition to the satisfaction of the owner, architect, and engineer. Backfilling and restoration below does not supersede or serve as a substitute for concrete encasement of raceways specified elsewhere.

A. Earth (and other unpaved surfaces) excavation: Backfill with suitable on-site material, preferably utilizing excavated material, and compact during backfill. Provide additional material to provide a flush surface after compacting or settlement. Provide seeding (as directed by the owner and architect) to restore grass surfaces.

B. Sidewalk (and other paved surfaces not subject to vehicular traffic) excavation: Where pavement construction joints are spaced not greater than 1.8m (6'0") apart, remove complete blocks of paving to the construction joints to facilitate excavation. Where construction joint spacing exceeds 1.8 m (6'0"), either saw cut pavement at a convenient location or remove to construction joints to facilitate excavation. Backfill with suitable on-site material, preferably utilizing excavated material and compact during backfill. Replace pavement sub-base with new materials to match existing sub-base materials. Replace pavement with new materials to match existing pavement.

C. Roadway and parking lot (and other surfaces subject to vehicular traffic) excavation: Saw cut pavement 76 mm (3") deep prior to excavation. Remove pavement 300 mm (1'0") beyond the edges of below grade excavation ("cut-back" pavement 300 mm (1'0") on both sides of trench). Backfill with suitable on-site material, preferably utilizing excavated material and compact during backfill. Replace pavement sub-base with new materials to match existing sub-base materials. Replace pavement with new materials to match existing pavement, filling the entire width of the excavation with "cut-backs".

D. Optional roadway and parking lot (and other surfaces subject to vehicular traffic) excavation: The following may be substituted for the methods indicated in item "C" above at the contractor's option. Saw cut pavement 76 mm (3") deep prior to excavation. Remove pavement to the same width as the edges of below grade excavation (without any "cut-back"). Back fill with concrete only to the bottom of the sub-base. Replace pavement sub-base with new materials to match existing sub-base materials. Replace pavement with new materials to match existing pavement.

15.5 Completely remove and properly dispose of any material excavated and not utilized for backfill, include all costs in bid.

16. HOUSEKEEPING AND EQUIPMENT PADS

16.1 Mount all fully or partially freestanding electrical equipment on pads as follows. Where equipment is installed without pad (without prior written approval) the contractor shall remove the equipment, provide a suitable approved pad, and reinstall the equipment (including providing temporary power [including the use and cost of a generator if required] to maintain service) at no cost to the owner.

16.2 Provide all floor/roof mounted equipment on 100 mm (4") concrete housekeeping pad.

16.3 Provide all outdoor ground mounted equipment on a suitable pad. Level grade around pad. Provide top of pad 155 mm (6") nominal above finished grade (100 mm (4") minimum at any point).

16.4 Provide all housekeeping and equipment pads in complete accordance with equipment manufacturer's requirements and recommendations. This includes, but is not limited to anchor bolts, reinforcement, minimum thickness, pad openings/cutouts, raceway stubs, overall dimensions/shape, steel leveling channels, concrete characteristics, grounding (including grounding grids and loops), and structural details. Where applicable, provide pads as per utility company standards. For any equipment exceeding 500 kg (1,100 lb), submit shop drawings of exact pad construction, fabrication, and characteristics. This

includes sealing (by a registered professional engineer) these shop drawings where requested by local authorities having jurisdiction for review.

16.5 Where approved by the manufacturer, engineer, and utility company (where applicable), pre-cast concrete pads and foundations may be utilized for outdoor installation. Install and set all pre-cast concrete pads on a smooth, compacted, and level base of not less than 155 mm (6") of crushed stone (or sand, for manhole style vault foundations 1.2 m (4'0") or deeper) according to manufacturer's (and utility company, where applicable) recommendations.

16.6 Where the project schedule, shutdown considerations, or other project conditions do not allow the time required for a cast-in-place indoor housekeeping pad, utilize a suitable custom pre-cast housekeeping pad (include all costs in bid). Pre-cast housekeeping pads may also be used under other conditions where approved in writing by the engineer and owner. Submit shop drawings for review and approval. Provide complete with openings pre-cast or cored in advance to facilitate conduit stub-ups (where applicable). Secure pad to the floor utilizing suitable concrete anchors. Set pad on wet bed of grout/mortar (to provide a firm and level surface regardless of floor surface conditions/irregularities) and utilize shims (to level pad and avoid pad settling before/while grout/mortar cures). Where a new cast-in-place pad will be poured adjacent to a new pre-cast pad, provide 10 mm (3/8") (minimum) reinforcement cast into and stubbed out from the pre-cast pad (extending at least 230 mm (9") and spaced not farther than 230 mm (9") on center) in the direction of proposed poured pad.

END OF SECTION

SECTION 16300 - ELECTRICAL MATERIALS

1. GENERAL PROVISIONS

1.1 The applicable requirements and conditions of specifications section "General Provisions" of specifications division 16100, General Electrical, are hereby made an integral part of this section.

1.2 The work governed by these specifications includes but is not limited to that as defined in specifications section "Scope of Work" of specifications division 16100, General Electrical.

1.3 Provide all materials and equipment (products) as new, the best in grade and quality, and manufactured in the United States of America with standards and ratings as specified herein. No substitution or deviation from the materials and equipment specified is permitted except by written permission from the engineer. Provide all materials and equipment as listed and/or labeled where applicable.

1.4 Replace or repair, to the satisfaction of the owner, any materials and equipment damaged before or after installation.

1.5 Materials and equipment manufacturers and catalog numbers specified constitute the type and quality of design, material, workmanship, ruggedness of construction, resistance to vandalism, exact operating and performance characteristics, features, configuration, dimensions, etc.. Where multiple manufacturers are shown in the drawings and/or specifications, not all manufacturers shown may be capable of providing materials and equipment meeting the specifications, field conditions, etc.. Manufacturers not specifically shown on the drawings or specifications shall be considered, provided the products are equivalent or superior to the requirements of the drawings and specifications (including equivalent or superior to products and/or manufacturers specifically shown on drawings and specifications). Manufacturers, whether shown on the drawings or specifications or not, are acceptable only if they can meet the specifications, conditions, and requirements specific to this project. The terms "equivalent", "equal", "equaling", and "approved equal" mean "equivalent or superior to the item/process specified when approved by the engineer", unless otherwise noted.

2. RACEWAYS

2.1 Steel Rigid Metal Conduit (RMC) and Steel Intermediate Metal Conduit (IMC)

A. Provide steel RMC as full weight, heavy wall, mild steel pipe, galvanized inside and outside.

B. Provide steel IMC as standard wall steel pipe; otherwise the same as steel RMC.

C. Provide fittings for steel RMC and steel IMC of high grade steel, having rust resistant finish, providing ample wiring space, having smooth round edges, and having full threaded hubs.

D. Utilize only fully threaded screw-on fittings with steel RMC and steel IMC (coat field-cut threads as per NEC Article 300.6(A)). Compression, set screw, bolt on, or other thread-less fittings are not permitted.

2.2 Electrical Metallic Tubing (EMT)

A. Provide EMT of high grade steel and galvanized inside and outside. Enamel coating only is not acceptable.

B. Provide fittings for EMT of high-grade steel, having rust resistant finish, providing ample wiring space, and having smooth round edges. For EMT in damp locations (i.e. concealed), utilize only fittings of the thread-less compression type without set screws. For EMT in dry locations only, thread-less set screw steel type fittings are permitted. Die cast, set screw, and indenter fittings are not permitted.

2.3 Flexible Metal Conduit (FMC) and Liquidtight Flexible Metal Conduit (LFMC)

A. Provide FMC ("greenfield") of high-grade steel, galvanized inside and outside, having a smooth interior, and providing a continuously effective ground. Provide fittings for FMC of high grade steel, having rust resistant finish, providing ample wiring space, having smooth round edges, of the two (2) screw type, listed and NEC approved for grounding.

B. Provide LFMC ("sealtite") with an overall PVC sheath; otherwise the same as FMC. Provide fittings for LFMC of high grade steel, having rust resistant finish, providing ample wiring space, having smooth round edges, listed and NEC approved for grounding, and of the sealing compression gland type.

C. Where applicable, provide FMC and LFMC manufactured to comply with NEC Article "Places of Public Assembly".

2.4 Polyvinyl Chloride Rigid Nonmetallic Conduit (PVC RNC)

A. Provide PVC RNC of virgin PVC (or material reground from the manufacturer's own products), heavy wall, schedule 40 or schedule 80.

B. Provide fittings for PVC RNC of schedule 40 virgin PVC, providing ample wiring space, and having smooth round edges. Make all interfaces between PVC RNC and raceways, enclosures, boxes, other conduit types, etc., utilizing adapter fittings designed for the purpose.

C. Make all joints utilizing solvent welding method, installed to be completely watertight and pressure-tight to 172 kPa (25 p.s.i.).

D. High density polyethylene (HDPE) conduit and type "EB" encased burial and type "A" PVC conduits are not permitted under any circumstance.

2.5 Surface Raceway

A. Surface raceway with integral wiring devices: Provide steel or aluminum type as indicated on the drawings. Utilize one (1), two (2), or three (3) compartment types (with dividers as applicable) as indicated on the drawings.

B. Surface raceway without integral wiring devices: Provide steel type. Utilize Wiremold types #V700, #V2000, #V2100, or #V2400 (or approved equal) sized

according to the number of conductors to be run in the raceway. Utilize the smallest size raceway facilitating conductors. Raceway smaller than #V700 type is not acceptable.

C. Surface raceway plug-in strips: Provide steel type, Wiremold #V2000 series (or approved equal). Provide with #12 AWG through wiring suitable for use on 20 A branch circuits. Provide with 15 A, 120 V single receptacles 300 mm (12") on center, unless indicated otherwise. Provide one (1) or two (2) circuit type as indicated on the drawings.

D. Provide all steel surface raceways in factory ivory finish. Provide final painting (over the ivory factory finish) as directed by the owner and architect in the field. Provide all aluminum surface raceways in natural brushed aluminum finish.

E. Nonmetallic surface raceways are not permitted, unless specifically indicated otherwise on the drawings.

F. Provide all installations of surface raceways complete including all required fittings, accessories, details of installation, etc.. Include costs in bid for installing surface raceways around all obstructions encountered.

G. Provide fittings for surface raceways manufactured by the surface raceway manufacturer and specifically designed to be used with and compatible with the surface raceway and the actual installation conditions encountered. Provide fittings for surface raceways having rust resistant finish, providing ample wiring space, and having smooth round edges. Provide device box type fittings as per the section of this specification "Outlet, Switch, and Junction Boxes".

H. Perform all cutting, bending, and offsetting of surface raceways and components utilizing tools specifically designed and manufactured for the purpose by the surface raceway manufacturer. Cutting with hacksaws and bending/offsetting with standard conduit benders is not acceptable. Where the manufacturer does not manufacture or supply tools to perform work required (as indicated in manufacturer's standard catalogs), use only tools specifically recommended and approved for the purpose by the manufacturer.

I. Fasten and secure all surface raceways utilizing hardware concealed by the surface raceway. Visible securing and fastening hardware is not acceptable except that Wiremold #V5703 (or approved equal) supporting "back clip" type fasteners are permitted with #V700 style surface raceway without integral wiring devices only. One (1) or two (2) hole straps over the raceway are not acceptable.

J. Specifications are based on equipment as manufactured by Wiremold. Equipment as manufactured by Hubbell and Mono-Systems (or approved equal) shall be considered.

3. OUTLET, SWITCH, PULL, AND JUNCTION BOXES

3.1 Provide boxes of proper types and sizes to facilitate installation and as per code at all outlets and junctions indicated on the drawings and as otherwise required.

3.2 In unfinished areas, mount boxes flush or exposed. In finished areas, mount boxes flush in ceilings, walls, and floors, include all required cutting and patching. Where impossible to mount flush in finished areas or where surface wiring is required to serve equipment in finished areas, finished style (Wiremold #V5730 to #V5760, equipment as manufactured by Hubbell or Thomas & Betts (or approved equal) shall be considered) surface boxes are permitted. Standard style pressed steel boxes are not permitted in finished areas. Where the contractor installs improper boxes in finished locations (without prior written approval), the contractor shall remove the boxes and install new boxes flush mounted (including cutting and patching to flush mount boxes and wiring and including replacing or reinstalling wiring) at no cost to the owner.

3.3 Utilize boxes of either unit or ganged construction and sized for devices and wiring installed and not smaller than the minimum sizes as per the drawings and specifications (and in no case smaller than the minimum size permitted by the NEC). Provide boxes as galvanized pressed steel (unless indicated otherwise), not less than 4" square, and with the proper size knockouts to facilitate wiring.

3.4 For flush mounted boxes, provide box shape permitting surfacing materials to be on straight lines and to fit closely around the box. Provide boxes in plastered, drywall (GWB), and similar walls, partitions, and ceilings with suitable plastering rings.

3.5 Utilize cast and/or malleable rust-resisting steel boxes for wiring in exterior, wet, or damp locations and for exposed visible steel RMC and IMC runs. Utilize aluminum or alloy boxes only where aluminum conduit is permitted by the specifications and used.

3.6 For all boxes in floors, utilize only boxes specifically designed, NEC approved, and listed for floor installation (including maintaining fire rating of the floor).

3.7 Provide all boxes for lighting outlets with studs of a size suitable for the weight of the luminaire supported (in no case less than 10 mm (3/8")). Provide the stud of integral construction with the box or of the type inserted from the back of the box. Studs held to the box with bolts to support luminaire weight are not permitted.

3.8 100 mm (4") diameter "octagon" boxes are not acceptable, except under the following conditions. Octagon boxes are permitted in conjunction with luminaire mounting studs where studs are required above. Octagon boxes are permitted where required to mount equipment where equipment is not compatible with square or ganged type boxes (including the use of adapter rings on square boxes).

3.9 Secure boxes firmly in place and set true, square, and flat or flush (as applicable) with finished surfaces. Keep all unused knockouts closed or close with suitable threaded plugs (for threaded knockouts or hubs) or knockout seals (for unthreaded knockouts). Install flush mounted boxes so the covers are flush with the finished surface.

3.10 Provide all boxes with cover plates as specified below.

4. COVER PLATES

4.1 Provide cover plates for switches, receptacles, outlet and junction boxes, and other devices of 1.0 mm (0.04") thick metal with paint finish or of stainless steel (as directed by the

owner and architect, include costs in bid for painted or non-magnetic stainless steel), unless indicated otherwise.

4.2 Utilize suitable pressed galvanized steel code gauge raised covers for exposed wiring methods in unfinished areas and accessible hidden locations. Flat pressed galvanized steel code gauge covers may be utilized on junction boxes (where devices are not installed) or for ganged devices (three (3) gang or greater only). Tile and/or plastering rings style covers are not permitted for exposed wiring methods under any circumstance.

4.3 Utilize cast rust-resisting steel or #302 stainless steel covers with gaskets for boxes in wet, damp, or exterior locations or other locations where cast steel boxes are utilized.

4.4 Provide suitable blank covers on all unused boxes and boxes for future use (including boxes where devices are not installed at the time that electrical work is completed; specifically including telephone/data outlets where jacks and covers are not installed).

5. CONDUCTORS AND CABLE (600 V)

5.1 Provide all wiring (for all systems) utilizing multiple single conductors in raceway, unless indicated otherwise. Conductor sizes indicated in the specifications and on the drawings are the minimum that will be accepted (conductor sizes are identified based on the NEC, as either American Wire Gauge [AWG] or thousands of circular mils [MCM or kcmil]). Where the contractor installs conductors smaller than the minimum size, the contractor shall remove conductors and install new conductors of the specified size at no cost to the owner.

5.2 Provide all conductors (including conductors in cables, where permitted) as 600 V, having flame retardant, heat resistant, and moisture resistant insulation, and listed and marked in accordance with industry standards and the NEC. Unless indicated otherwise, provide all conductors identified both as type "THHN" and as type "THWN" ("THHN/THWN"), rated 90 degrees C for dry and damp locations and rated 75 degrees C for wet locations. Conductors identified as type "XHHW" (in lieu of type "THHN/THWN") are permitted only where conductors are of the compact stranded type (type "XHHW" is not permitted for solid conductors or for standard concentric or compressed stranded conductors). Provide all conductors for all systems of a type suitable for installing in dry, damp and wet locations. Conductors suitable for dry locations only and conductors suitable for dry and damp locations only are not acceptable (except as specifically otherwise provided for plenum rated systems cables).

5.3 Provide all conductors of soft drawn copper (Cu, CU) wire of 98% conductivity. Aluminum (Al, AL) conductors are not acceptable, unless specifically indicated otherwise on the drawings.

5.4 For wiring installed in high temperature locations subject to temperature exceeding 60 degrees C (140 degrees F), utilize conductors with special heat resistant insulation based on and listed for exact temperature conditions and location classifications encountered (consult engineer for exact conductor type; include costs in bid to utilize any of types "FEPB" (glass braid type only), "MI", "PFA", "SA", "THWN-2", "Z", and "ZW"). Install wiring in high temperature locations in conduit raceways (surface raceways and cable wiring methods without conduit are not permitted, except type "MI" cable); provide respective conduit sizes in accordance with NEC raceway fill requirements. Transition to standard conductor types

are permitted (in a suitable junction box) beyond the minimum distance as per NEC Article 310.15(A)(2), Exception, measured from the first point where normal ambient temperature occurs.

5.5 Where permitted elsewhere in this specification, provide metal clad cable (type "MC") having interlocked steel or aluminum cladding and having conductors as specified above, including an insulated grounding conductor. Provide conductors #10 AWG and smaller as solid and conductors #6 A.W.G and larger as stranded. Conductors #8 AWG may be solid or stranded. Provide type "MC" cable listed and NEC approved to provide an acceptable grounding path. Provide fittings for type "MC" cable of suitable pressure pad/clamp type, high grade steel, having rust resistant finish, providing ample wiring space, having smooth round edges, and having full threaded hubs. Fittings utilizing set screws are not acceptable. "Snap-in" fittings of any kind (including, but not limited to, fittings designed to fasten in knockouts or hold cable with spring tension, fittings without treaded hubs, and fittings designed to be installed without the use of tools) are not acceptable. Provide type "MC" cable as listed and install in complete accordance with NEC Article 330. Where permitted by the NEC (including Article 604), listed manufactured wiring systems consisting of cables identified as type "MC" may be utilized wherever specifications allow the use of type "MC" cables. Where permitted by the NEC (including Articles 725 and 770), listed type "MC" cables containing Class 2 and Class 3 cable and/or optical fiber members in addition to power conductors may be utilized wherever specifications allow the use of type "MC" cables.

5.6 Where permitted elsewhere in this specification, provide armored cable (type "AC") having interlocked steel or aluminum armor and having conductors as specified above along with a code sized copper or aluminum (compatible with armor material) armor bonding wire. Provide conductors #10 AWG and smaller as solid and conductors #6 A.W.G and larger as stranded. Conductors #8 AWG may be solid or stranded. Provide type "AC" cable listed and NEC approved to provide an acceptable grounding path. Provide fittings for type "AC" cable of suitable pressure pad/clamp type, high grade steel, having rust resistant finish, providing ample wiring space, having smooth round edges, and having full threaded hubs. Fittings utilizing set screws are not acceptable. "Snap-in" fittings of any kind (including, but not limited to, fittings designed to fasten in knockouts or hold cable with spring tension, fittings without treaded hubs, and fittings designed to be installed without the use of tools) are not acceptable. Provide type "AC" cable as listed and install in complete accordance with NEC Article 320. Where permitted by the NEC (including Article 604), listed manufactured wiring systems consisting of cables identified as type "AC" may be utilized wherever specifications allow the use of type "AC" cables.

5.7 Where direct buried cables/conductors are specifically indicated on the drawings, provide conductors as 600 V, having flame retardant, heat resistant, moisture resistant, and sunlight resistant insulation and identified and listed as types "RHH/RHW-2/USE-2". Where messenger supported aerial multiplex cables are specifically indicated on the drawings, provide conductors as 600 V (with flame retardant, heat resistant, moisture resistant, and sunlight resistant insulation of a type in accordance with the NEC) with bare messenger to support the cable (hard drawn for copper conductors or ASCR for aluminum conductors).

6. SPLICES, TAPS, AND CONNECTIONS

6.1 Make all splices, taps, and connections at locations indoor and above ground only. Splices, taps, and connections are not permitted below grade (including below any floor level where

the floor is in direct contact with earth, i.e. basement slabs, slabs on grade, etc.), or where subject to being submerged (except as specifically provided as follows). Route raceways and wiring accordingly and include all costs in bid. Where physically impossible to install wiring to make splices/taps above grade, splices/taps below grade shall be considered where specifically requested in writing in advance (prior to installing conductors) by the contractor and where approved in writing by the engineer. Specifically and individually identify each and every case involved for below grade splices/taps in the request(s) and submit shop drawings for splices/taps (as indicated below). Where below grade splices/taps are installed by the contractor (without prior written approval) the contractor shall remove the raceways, wiring, splices, and taps and install new raceways and wiring in such a manner to completely avoid below grade splices/taps at no cost to the owner.

6.2 Perform all splices/taps in suitable code sized outlet and junction boxes only, not in raceways, conduit bodies, or equipment cabinets. Clean each strand of conductors carefully before connecting.

6.3 Where aluminum wiring is permitted elsewhere in this specification or where connecting to existing aluminum wiring, utilize only suitable crimp-on compression connectors/lugs. Bolted pressure type connectors/lugs are not acceptable under any circumstance. Where aluminum wiring terminates in factory installed bolted pressure lugs at equipment, utilize suitable crimp-on compression adapters (Ilsco #CPM, #ACM, and #ACO types or approved equal).

6.4 Insulation piercing type splices, taps, and connections of any kind are not permitted under any circumstance (including where applied after removing insulation).

6.5 Provide connections at equipment, apparatus, and devices for a complete installation and as follows. Coordinate all requirements with equipment to connect.

A. Where equipment includes factory "pig tails" for connections, make connections as specified above for splices and taps.

B. For stranded wiring #10 AWG and smaller, utilize suitable crimp-on "stacon" type terminals. Where equipment terminals include pressure pads, wiring may terminate directly at equipment without crimp-on terminals. Connecting stranded wiring directly at wire binding screw terminals (i.e. wrapped around screw) is not permitted under any circumstance.

C. For solid wiring #8 AWG and smaller, provide wiring connecting directly at terminals.

D. For wiring #6 AWG and larger and #8 AWG stranded wiring, utilize suitable crimp-on compression lugs. Where equipment is provided with factory-installed lugs, wiring may connect directly at factory lugs.

6.6 Where equipment (including equipment furnished by other contractors or the owner) is provided with factory installed lugs and the factory-installed lugs do not facilitate the specified wiring sizes, provide complete connections as summarized for the following options. Options "A" and "B" apply where the specified conductors are either larger than the maximum conductor for the lug or smaller than the minimum conductor for the lug. Option "C" applies where the specified conductors are larger than the maximum conductor for the lug.

A. Remove factory lugs and provide new suitable field-installed lugs. This option is not permitted where removal and replacement of lugs would violate equipment listing or where factory lugs are not removable.

B. Utilize suitable crimp-on compression reducing adapters to splice between specified conductors and conductors compatible with factory lugs. Perform this splice within the equipment enclosure containing the factory lugs (where there is sufficient NEC required space for splices) or in a code sized junction box outside of the equipment enclosure (where sufficient space is not available). Install splices as indicated above for splices and taps. Provide conductors between the reducing adapters and the factory lugs insulated, as short as practical, and sized as per the NEC and the factory lugs. Utilize Burndy types #YSV, #YRV-L, #Y-R (Cu), and #YRB (Cu/Al) reducing adapters (or approved equal). Coordinate exact types and sizes with actual conductors involved.

C. Utilize suitable crimp-on compression pin type adapters on the end of conductors connecting in the factory-installed lugs. Utilize Burndy types #YE-P, #YE-P-FX (Cu), #AYP, and #AYPO (Al) pin adapters (or approved equal). Coordinate exact types and sizes with actual conductors and factory lug size involved.

6.7 Provide splices and taps at indoor locations and outdoor locations above ground (excluding exposed outdoor splices/taps) as follows.

A. For stranded wiring #10 AWG and smaller and solid wiring #8 AWG and smaller, make splices/taps by twisting conductors together and utilizing suitable pressure type "wire nut" connectors. Tightly over-wrap with vinyl insulating tape. Utilize listed wire nuts with internal coiled square metal binding spring ("all plastic" and porcelain wire nuts are not acceptable under any circumstance). For splices/taps in wet locations, utilize only "self-sealing" wire nuts with integral water repellent non-hardening sealant (Ideal #60 "DB Plus" or approved equal).

B. For wiring #6 AWG and larger and for #8 AWG stranded wiring, make splices/taps utilizing suitable crimp-on compression connectors. Bolted type connectors are not permitted, except where available crimp-on compression connector configurations do not correspond to combinations and arrangement of conductors to be connected. Wrap with rubber insulating tape or vinyl mastic of type, thickness, and insulation level equaling or exceeding the original insulation then tightly over wrap the entire assembly with vinyl insulating tape covering all rubber tape/mastic without gaps or voids.

6.8 Provide all splices and taps underground, below grade, and subject to being submerged (where specifically approved in writing by the engineer) as follows. Provide splices/taps of direct buried and open aerial wiring (where specified elsewhere) as follows. Submit shop drawings for all proposed splice/tap products and methods. Where any splice/tap is installed in any underground, below grade, submerged, or exposed wet or outdoor location for which shop drawings are not previously submitted, the contractor shall disconnect and remove the installed splices/taps and provide new acceptable splices/taps (as directed by the engineer) at no cost to the owner.

A. Utilize manufactured or pre-engineered splices/taps specifically designed and listed for the application, including being suitable for installation underground, direct buried, submerged, and in wet locations. Provide outdoor exposed splices/taps also as sunlight resistant. Pre-molded, heat-shrink, and cold-shrink manufactured kits and engineer approved pre-engineered hand-wrapped tape kits shall be considered.

B. For underground splices/taps of stranded wiring #10 AWG and smaller and solid wiring #8 AWG and smaller only, splices/taps may be made as follows. Permanently electrically connect conductors by either of the following options:

1) Twist conductors together then solder conductors. Utilize suitable pressure type wire nut connectors with integral water repellent non-hardening sealant (Ideal #60 "DB Plus" or approved equal) to mechanically bind the soldered splice/tap and tightly over wrap with vinyl insulating tape.

2) Splice/tap conductors with suitable insulated crimp-on connectors and tightly over wrap with vinyl insulating tape.

Once electrically connected, embed splices/taps in sealant compound. Utilize only engineer approved hardening flexible sealant (i.e. "bondo" traffic detector loop style sealant; contact the engineer for information and submit shop drawings for approval). Place sealant (uncured liquid) in a suitable container, immerse splices/taps in sealant in the container, and rigidly support splices, taps, and conductors in place until sealant has set.

C. Self-sealing wire nuts (used alone and/or when over wrapped with vinyl insulating tape) are not an acceptable substitute for splices/taps as specified in items "A" and "B" above.

6.9 Splices, taps, and connections (and associated materials) as manufactured by Burndy, Elastimold, G&W, Homac, Ideal, Ilsco, Mac Products, O-Z/Gedney, Plymouth, Raychem, Skotch/3M, and Thomas and Betts/Blackburn (or approved equal) shall be considered.

7. GROUNDING MATERIALS

7.1 Provide all material used for grounding of non-ferrous copper. Aluminum is not acceptable, unless specifically indicated on the drawings.

7.2 Provide all driven (made) grounding rod electrodes of copper or copper clad steel, minimum 19 mm (3/4") diameter by 3.0 m (10'0") long.

7.3 Provide all grounding conductors in accordance with the section of this specification "Conductors and Cable (600 V)", except as follows. Grounding conductors may be insulated or bare, except as follows. Wherever grounding conductors #6 AWG and smaller are insulated, provide insulation colored green. Provide "isolated" grounding conductors as insulated only (green with yellow tracer). Provide grounding conductors run in raceway/cable with wiring as insulated only (bare conductors are not permitted for grounding conductors run with wiring, except cable wiring methods permitted elsewhere in the specifications where insulated grounding conductors are not available).

7.4 Provide all grounding connections as per the section of this specification "Splices and Taps", except as modified below. Grounding connections do not require insulation.

7.5 For wiring #4 AWG and larger, provide all grounding connections utilizing exothermic weld process (Erico/Cadweld, Thermoweld, Thomas & Betts, or approved equal). Crimp-on compression type connectors may be used only where available exothermic weld process connection configurations do not correspond to combinations and arrangement of conductors to be connected. Bolted type connectors are not permitted, except where available exothermic weld process and crimp-on compression connector configurations do not correspond to combinations and arrangement of conductors to be connected. Where equipment is provided with factory installed lugs, #4 AWG and larger wiring may terminate directly at factory lugs.

7.6 Utilize only exothermic weld process connections for all concealed grounding connections (compression, mechanical, and other grounding connections are not permitted concealed). Where available exothermic weld process connection configurations do not correspond to combinations and arrangement of conductors to be connected in concealed locations, utilize combinations and arrangement of conductors necessary to facilitate exothermic weld process connections and extend from the concealed connection location to an accessible location where crimp-on compression or bolted type connections may be utilized (as permitted above).

7.7 Accessible connections of wiring #6 AWG and smaller to piping and similar materials/equipment may utilize multiple-bolt type ground clamps. Accessible connections of wiring #6 AWG and smaller to driven (made) grounding rod electrodes may utilize one-piece, single bolt "acorn" type ground clamps.

7.8 Provide conduit grounding bushings of galvanized malleable iron with integral screw pressure connector or provisions to accept factory or field installed lug where required.

8. IDENTIFICATION, NAMEPLATES, AND TAGS

8.1 Provide all new electrical equipment with engraved three (3) layer laminated plastic nameplates describing the equipment, load/device served, ratings, circuit(s) feeding the equipment, etc. as indicated below. Provide engraved plastic nameplates for existing electrical equipment where modified or connected to as part of this project or where specifically indicated on the drawings. Provide these engraved plastic nameplates in addition to any code required or manufacturers' standard nameplates.

8.2 Provide engraved plastic nameplates for all electrical equipment, including, but not limited to, safety switches, enclosed circuit breakers, branch panels, distribution panels (including branch circuit breakers and circuit breaker spaces), transformers, any equipment containing fuses, power outlets, thermal overload switches, contactors, time clocks, photocells, meter sockets, modular meter centers, fire alarm equipment and devices, lighting controllers, dimming cabinets, capacitors, snow melting equipment, generators, motor control centers, motor controls (starters, variable frequency drive [VFD] units, etc.) where furnished by the electrical contractor, high voltage equipment, etc. (where applicable). Provide engraved plastic nameplates for all receptacles and switches where dedicated to serving specific equipment. Provide engraved plastic nameplates for convenience receptacles (only where indicated on the drawings).

8.3 Secure engraved plastic nameplates with suitable screws or rivets, self-adhesive nameplates are not acceptable. Provide engraved plastic nameplates with white letters on black background, unless indicated otherwise. Provide engraved plastic nameplates with 6.5 mm (1/4") minimum lettering, unless indicated otherwise. Provide engraved plastic nameplates on the front and/or cover of the equipment plainly visible when the cover (where applicable) is closed, unless indicated otherwise.

8.4 Submit shop drawings showing proposed sizes (overall and lettering sizes) and exact proposed wording (including exact arrangement of wording) of all engraved plastic nameplates for review and approval.

8.5 Provide all engraved plastic nameplates in accordance with the following example. Equipment names are the alphanumeric designation for equipment indicated on the drawings (i.e. "MDP", "PP1", "EF-1", etc.). Equipment descriptions identify the equipment in "plain English" (see example). Indicate the operating voltage of the equipment, including phase and wires (see example). Where equipment includes overcurrent devices (i.e. main breaker panels, fused switches, enclosed circuit breakers, etc.) show the appropriate amperes on the engraved plastic nameplate. Where equipment does not include overcurrent devices (i.e. main lug panels, unfused switches, contactors, transformers, etc.) show the amperes of the overcurrent device protecting the circuit serving the equipment. Remarks include information as described below.

EXAMPLE ENGRAVED PLASTIC NAMEPLATE WORDING

Equipment Name (use 10 mm (3/8") lettering):	PP1
Equipment Description:	POWER PANEL
Equipment Voltage, Phase, Amperes:	120/208V-3PH-4W, 100A
Remarks:	FED FROM MDP - CCT. 4

A. Branch Panel: Provide engraved plastic nameplate showing panel name and use (description) as indicated on the single line diagram and/or respective panel schedule. Remarks indicate the panel and circuit number or transformer feeding the panel.

B. Distribution Panel: Provide "master" engraved plastic nameplate on the front cover showing information as indicated above for branch panels. For multiple section panels, locate master nameplate on the section containing the main breaker or incoming line main lugs. Remarks indicate the panel and circuit number or transformer feeding the panel (i.e. sub-distribution panel) or indicate "Service Disconnect" if a service entrance distribution panel. Provide additional nameplates for all branch circuit breakers and circuit breaker spaces (see below).

C. Branch Circuit Breaker in Distribution Panel: Provide engraved plastic nameplate for each new circuit breaker within a distribution panel (including breakers in existing panels connected to as part of this project). Show the name and description of equipment/load fed. Voltage and phase are not required on these nameplates. Amperes are not required on these nameplates if the rating is clearly and visibly indicated on the circuit breaker. Where adjustable trip circuit breakers are used, show the proper ampere setting on this nameplate. Remarks indicate the approximate location of the equipment/panel served. Where the distribution panel includes a hinged overall cover door, provide these nameplates mounted inside the hinged door.

D. Circuit Breaker Space in Distribution Panel: Provide engraved plastic nameplate for each circuit breaker space within a new distribution panel. Show the word "SPACE" and the maximum circuit breaker poles and frame size ampere rating. Equipment name, description, voltage, and remarks are not required on these nameplates. Where the distribution panel includes a hinged overall cover door, provide these nameplates mounted inside the hinged door.

E. Safety Switch/Enclosed Circuit Breaker: Provide engraved plastic nameplate with the name and description of equipment/load fed. Remarks indicate the panel and circuit number or transformer feeding the switch/breaker. Ampere rating may be omitted if the proper rating is clearly indicated on the switch/breaker and is visible with the cover closed. Where fusible switches are used, show the fuse ampere rating. Where adjustable trip circuit breakers are used, show the proper ampere setting.

F. Fusible Device: On the inside cover of each fused device, provide an engraved plastic sign indicating the proper fuse size (as indicated on the drawings or otherwise required). Provide nameplate reading, "USE ___A FUSE ONLY" (fill in the proper fuse rating).

G. Transformer: Provide engraved plastic nameplate with the name and description of equipment/load fed. Show both the primary and secondary voltages and phase as well as the transformer kVA rating. Ampere ratings are not required. Remarks indicate the panel and circuit number feeding the transformer.

H. Metering: Wherever new metering equipment is installed (including meters, meter sockets, meter boards, digital panel metering units, etc.), provide engraved plastic nameplate showing panel name(s) served by the meter as indicated on the single line diagram and customer buying electricity (description) as verified with the owner. Remarks indicate the panel and circuit number or transformer feeding the panel (or indicate "Fed From Service" if a utility meter). Show service voltage and phase of the metered feeder (not necessarily the meter voltage). For transformer rated metering installations, show current transformer (CT) ratio in place of ampere rating (i.e. "400:5 CT"). For self-contained metering (without CT's), show ampere rating of the metered feeder.

8.6 Provide engraved plastic nameplates for power outlets, thermal overload switches, and for receptacles and switches where dedicated to serving specific equipment. Show the equipment served, the voltage and ampere rating, and the circuit feeding the equipment. Utilize 3.2 mm (1/8") high minimum lettering. Provide as per the following example:

Equipment Name and Description:	MO-1 MICROWAVE OVEN
Equipment Voltage and Amperes:	120V, 20A - PP1-12

8.7 Where specifically indicated on the drawings only, provide engraved plastic nameplates for convenience receptacles showing the voltage and ampere rating and the circuit feeding the receptacle. Utilize 3.2 mm (1/8") high minimum lettering. Provide as per the following example:

Equipment Voltage and Amperes:	120V, 20A
Equipment Circuit:	PP1-14

8.8 Provide engineer approved wrap-around adhesive or tube type wire tags or markers for all conductors, except conductors in feeders tagged as indicated below. Provide tags/markers indicating the panel or device where the wiring originates and the conductor circuit number (or other identifying number/letter/designation unique to the conductor). Tag/mark neutral and grounding conductors with the respective circuit number(s) of the corresponding phase conductor(s).

8.9 Provide engineer approved tags for all panel feeders (regardless of ampere rating) and other circuits (600 V and less) rated 100 A and larger, at both ends and at all intermediate junction and pull boxes. Provide tags indicating the circuit designation or equipment served, panel name and circuit number (or other source of feeder), and stating the voltage, phase, and amperes of the circuit. Provide tag wording and layout similar to engraved plastic nameplates as indicated above.

8.10 Where any conductor size differs from the conductor size normally expected for the respective overcurrent device (for any reason, whether specified or not, including voltage drop, NEC "tap rule" application, ampacity de-rating, etc.), provide engineer approved tags at the point where the wiring terminates at the overcurrent device reading, "WIRING IS ADJUSTED FOR VOLTAGE DROP/TAP RULE/DE-RATING, USE MAXIMUM ___A FUSE/CB" (indicate the proper reason for the adjustment and fill in the proper overcurrent device ampere rating). For feeders, this information may be included on the tags specified above.

8.11 Provide engineer approved plastic tags for all primary feeders (over 600 V) identifying the feeder number/designation and service voltage. Provide feeder numbers and exact tag configuration and information as designated by the owner and/or engineer during construction. Apply tags after applying cable fire protection tape, where applicable.

8.12 Provide all new and existing branch panels (where connected to or modified as part of this project) with accurate and descriptive typewritten circuit directories. For existing panels, provide directories including all modifications as part of this project as well as all previous "penciled in" changes and information. Actual tracing and identifying of existing circuits is not required, unless specifically indicated on the drawings. Submit photocopies of circuit directories as part of as-built record documents.

8.13 Provide all new electrical equipment with all caution, danger, and warning signs or indications required by any applicable regulation, code, standard, or manufacturer's recommendation (provide as listed where applicable and refer to specifications section "Regulations and Codes" of specifications division 16100, General Electrical). This includes, but is not limited to NEC Articles 100, 110, 200, 230, 250, 450, 490, 504, 513, 516, 550-552, 585, 620, 647, 665, 669, 690, 692, 700, 705, etc., as applicable.

8.14 Identify conductors in complete accordance with the NEC and as indicated below (including identifying "high-leg", grounding, and grounded (i.e. neutral) conductors, where applicable). For conductors #6 and smaller, identify by natural insulation color. For conductors #4 and larger (and for cable wiring methods where applicable colors are not readily available from cable manufacturers), identify by natural insulation color or by a 155 mm (6") long (minimum) band of colored vinyl electrical tape on conductors at all terminations and in all boxes and enclosures. Where "tracers" are required, identify by natural insulation color including narrow stripes of the tracer color. Where conductors

including tracer stripes are not readily available, provide a 25 mm (1") band of tape (apply over and in the center of the 55 mm (6") band of tape, where applicable) of the tracer color at all terminations and in all boxes and enclosures.

8.15 Identify phases of all conductors where more than one phase conductor is present (in raceways, cables, boxes, enclosures, etc.) with methods as indicated above. Utilize standard color-coding throughout the project as follows:

120/208/240 V SYSTEM

A-phase	Black
B-phase	Red (utilize orange if 120/240V-3PH-4W midpoint grounded delta (i.e. "high-leg") system)
C-phase	Blue
Neutral	White
Ground	Green

277/480 V SYSTEM

A-phase	Brown
B-phase	Orange (utilize purple where orange is used for 120/240V-3PH-4W delta system above)
C-phase	Yellow
Neutral	White with brown tracer(s)
Ground	Green

Isolated ground conductors (any system): Green with yellow tracer(s)

OVER 600 V SYSTEMS

Utilize multiple 51 mm (2") wide bands of colored tape to identify phases. Utilize yellow for 5 kV nominal, red for 15 kV nominal, and orange for 25/35 kV nominal.

A-phase	Single band
B-phase	Two (2) bands
C-phase	Three (3) bands

8.16 The electrical contractor shall provide new OSHA approved "DANGER - HIGH VOLTAGE" signs on all doors which directly enter any room containing exposed live parts or containing new or existing equipment operating at over 600 V (where connected to or modified as part of this project). Provide new signs even if existing signs are present (except that new signs are not required where existing signs are OSHA approved type complying with *current* OSHA standards).

9. LOCKS AND KEYS

9.1 Provide all locks for lighting and power panels, fire alarm and signaling cabinets and all other electrical systems or locked apparatus with keys which are alike.

10. RECEPTACLES AND SWITCHES

10.1 Provide all receptacles and switches as industrial and specification grade, totally enclosed in non-flammable and heat resistant heavy-duty thermoset or thermoplastic case, with

terminal screws on the side of the case. Pigtail conductor connections are not permitted (except for specialty devices where side terminal screws are not available options in the manufacturer's catalog), unless specifically indicated otherwise. Provide color as selected and approved by the owner and architect.

10.2 Provide receptacles as duplex, parallel blade, side wired, three (3) wire, grounding type, 20 A, 120 V, and listed as "tamper-resistant", unless specifically indicated otherwise on the drawings. Listed combination receptacle and separable snap-in wiring terminal assemblies (Hubbell "SNAPConnect" style, Pass & Seymour "PlugTail" style, or approved equal) may be used and may utilize pigtail connections on the wiring terminal assemblies.

10.3 Provide weatherproof receptacles listed as weather-resistant type and mounted in a weatherproof box with gasket and single spring-hinged weatherproof-while-in-use cover over both receptacle positions.

10.4 Provide receptacles at accessory buildings (at or below grade), bathrooms (including rooms containing bathtubs or showers), boat hoists, boathouses, crawl spaces, dishwashers, garages, janitor closets, kitchens, kitchenette counters, laundry areas, outdoors, rooftops, unfinished basements, wet locations, within 6'0" of any sink, and as indicated on the drawings or required by the NEC with integral ground fault circuit interrupter (GFCI) protection for personnel with trip characteristics as per the NEC and UL standards. Utilize only weather-resistant type receptacle mounted in a weatherproof outlet box with single spring-latched weatherproof-while-in-use cover for boat hoists and in all outdoor, rooftop, and wet locations. Feed-through protection of standard type receptacles from other GFCI receptacles is not acceptable (unless specifically indicated otherwise on the drawings). Protection of standard type receptacles in readily accessible locations from GFCI circuit breakers is not acceptable (see below for inaccessible receptacles). For inaccessible receptacles (locations which are not readily accessible as per the NEC, for example where located behind equipment, appliances, or obstacles) the use of GFCI type receptacles is prohibited and protection of standard type receptacles from GFCI circuit breaker must be used (identify receptacles as protected as per the NEC). Provide compliant GFCI protection wherever required by the NEC whether indicated on the drawings or not.

10.5 Where indicated on the drawings, provide isolated ground type receptacles with the receptacle grounding terminal electrically isolated and insulated from the receptacle mounting yoke. Where indicated on the drawings, provide with integral transient voltage surge suppressor (TVSS, with integral light emitting diode (LED) indicating integrity of TVSS protection) with TVSS components rated 150 V, 210 J (at 10 x 1,000 μs), and 13 kA (minimum) and complying with UL-1449. Provide all wiring serving isolated ground receptacles with separate equipment and isolated grounding conductors as per specifications section "Grounding" of specifications division 16200, General Electrical. Where isolated ground type receptacles are shown in nonmetallic raceways or nonmetallic boxes, either ground the metal receptacle yoke (in addition to grounding the receptacle ground terminal) with the equipment (raceway) grounding conductor (utilizing methods approved by the NEC) or substitute a standard (i.e. non-isolated-ground) type receptacle (but with TVSS where specified) so the receptacle yoke is grounded by the isolated ground conductor, at the contractor's option.

10.6 Provide wall switches as single pole, three-way, or four-way as applicable, heavy duty flux tumbler type, UL "T" rated, specification grade, and rated 20 A, 277 V and 120 V.

10.7 Provide horsepower rated single-pole thermal overload switches (manual motor starters, O/L switches, etc.) with thermal overload heater element coordinated with equipment served. Where overload protection is not required (where the switch acts only as disconnecting means) provide overload heater element rated in excess of the branch circuit breaker amperes.

10.8 For all switches where locking provisions are required by Code or indicated on the drawings and for all thermal overload switches, provide a suitable handle locking guard capable of visibly padlocking in the open or closed position (with switch handle position visible when locked).

10.9 Provide dimmer switches of thin profile slide type ("off" when slider is in the lowest position), Lutron #NT series (or approved equal by Hubbell or Leviton), unless indicated otherwise. Dimmer switches of the rotary type, with raised profile (with raised cooling fins), and/or with on/off toggle separate from slider are not acceptable. Provide with full wattage rating as indicated on the drawings, do not "de-rate" by removing cooling fins or heat sink sections (unless specifically indicated on the drawings). Where multiple dimmer switches or dimmer switch(es) along with standard type switches (single pole, three-way, and four-way) are shown grouped together on the drawings, gang switches together with a single overall cover plate (conform with NEC Article 404.8(B) "Voltage Between Adjacent Switches", where applicable). Utilize special cover plates based on the combination of switches involved. Where ganged with dimmer switches, utilize single pole, three-way, and four-way switches of the slide type with appearance and manufacturer matching dimmer switches.

10.10 For all receptacles at any location in hospitals and in patient care and/or treatment areas in other occupancies (doctors/nurses offices, athletic training, first aid rooms, etc.) provide receptacles as hospital grade (in addition to requirements above) and provide wiring feeding the receptacles complying with NEC Article 517.13

11. SAFETY SWITCHES

11.1 Provide all safety switches (disconnect switches) of the quick-make and quick-break type, with contacts not marked or shielded, designed to function if the operating spring fails or is removed, with mechanical interlock so operation is impossible when the cover is open (provide means to manually bypass/defeat the interlock), with provisions for padlocking in both the open and closed positions, and of the heavy duty type. Provide switches with voltage ratings equaling or exceeding the operating voltage. Provide indoor switches with NEMA-1 enclosures. Provide outdoor switches with NEMA-3R enclosures. Where NEMA-4X enclosures are specifically indicated on the drawings only, provide of the stainless steel type only.

11.2 Provide fuse clips in fusible switches to facilitate fuses as per the section of this specification "Fuses". Provide suitable "rejection" type clips to prevent replacing fuses with short circuit ratings lower than specified.

11.3 Provide safety switches with ground busses. Where neutral conductor is present, provide safety switches with separate neutral busses (with provisions for bonding, bond where required by the NEC).

11.4 For all safety switches on the load side of variable frequency drive (VFD) units, provide safety switches with integral "electrical interlock" auxiliary contacts (one (1) N.O. and one (1) N.C., minimum) which "break" before safety switch opens. Provide two (2) #14 AWG interlock conductors run (in raceway with line side power conductors) from auxiliary contact to VFD unit. The VFD supplying contractor shall connect interlock wiring at VFD unit to shut down VFD unit if safety switch is opened to prevent operating VFD without load connected.

11.5 For safety switches serving elevators, provide safety switches with integral "electrical interlock" auxiliary contacts (one (1) N.O. and one (1) N.C., minimum) which "break" before switch opens. Provide two (2) #14 AWG interlock conductors run (in raceway with load side power conductors) from auxiliary contact to elevator controller. Elevator contractor shall connect interlock wiring at elevator controls.

11.6 Equipment as manufactured by ABB/GE, Eaton, Schneider, and Siemens (or equivalent) shall be considered.

12. FUSES

12.1 Provide an NEC cartridge fuse for each fuse-gap in the work. Furnish three (3) spare fuses of the rating installed to the owner for each fused device. Specifications are based on equipment as manufactured by Eaton/Bussman. Equipment as manufactured by Mersen and Littlefuse (or approved equal) shall be considered.

12.2 Provide fuses of the dual element time delay, current limiting, and non-renewable type with voltage rating not less than the operating voltage and coordinated with the respective fuse clips and with short circuit rating of 200,000 A. Provide fuses as class "RK1" (600 A and less, Eaton/Bussman #LPN/S-RK series) or class "L" (over 600 A, Eaton/Bussman #KRP-C series). Class "CC" fast acting (Eaton/Bussman #LP-CC series) or time delay (Eaton/Bussman #KTK-R series) fuses, as recommended by manufacturer, are permitted for control applications.

13. CIRCUIT BREAKERS

13.1 This section applies to all circuit breakers installed within or in conjunction with branch and distribution panels, enclosed circuit breakers, contactors, starters, and any other electrical equipment, unless indicated otherwise.

13.2 Provide all circuit breakers of the molded case type unless specifically indicated otherwise. Provide readily removable from the front of panels and equipment without disturbing adjacent units, having quick-make and quick-break toggle mechanisms and non-fusible contacts, having inverse time and short circuit characteristics, which trip free on overload or short circuit so that they cannot be held closed on overload, clearly indicating whether they are in the open, tripped, or closed position. Provide automatic release obtained through the medium of a bimetallic thermal type element (ambient compensated) engaged in the releasing latch of the breaker or mechanism.

13.3 Provide circuit breakers in branch and distribution panels with short circuit ratings as indicated in the respective equipment specifications. Provide circuit breakers as part of

enclosed circuit breakers, contactors, starters, and any other electrical equipment with short circuit ratings not less than the short circuit rating of the first overcurrent device on the line side of the breaker, unless indicated otherwise on the drawings.

13.4 Provide field-installed handle locking devices for all circuit breakers not requiring switch control, for all circuit breakers feeding emergency lighting equipment (including battery equipment) and fire alarm controls, and for all circuit breakers fed from an emergency generator system (where applicable).

13.5 Provide 15 A and 20 A circuit breakers "SWD" and "HID" rated. Provide branch panel (250 V and less) circuit breakers rated 70 A and less as "HACR" rated. Provide enclosed circuit breakers and circuit breakers in distribution panels rated 250 A and less as "HACR" rated.

13.6 For all 120 V, 20 A and 120 V, 15 A circuits (including multi-wire branch circuits feeding 120 V loads) serving any new or existing outlets (receptacle outlets, lighting outlets, fan outlets, equipment outlets, utilization outlets, etc.) in any dwelling unit family room, dining room, living room, parlor, library, den, bedroom, sunroom, recreation room, closet, hallway, or similar room or area, provide branch circuit breakers of the arc fault circuit interrupter (AFCI) type. This does not apply to circuits rated 208 V and greater or circuits rated 30 A and greater. For the purposes of this section, bedrooms include all bedrooms, hotel/motel guest rooms, dormitory rooms, and any other room capable of being converted to or used as a bedroom or for sleeping. Provide as NEC approved and listed for the purpose. Provide whether indicated on the drawings (including panel schedules) or not, include all costs in bid.

13.7 Provide all circuit breakers over 250 A of a type with interchangeable trip units. Provide all circuit breakers rated 1,000 A or larger and operating at over 250 V with integral ground fault protection for equipment. Unless alternative means for arc energy reduction are specifically indicated otherwise on the drawings or specifications, provide all circuit breakers rated 1,200 A or larger with an individual energy-reducing maintenance switch with local status indicator.

13.8 Short Circuit, Coordination, and Arc Flash Report: Where circuit breakers include or facilitate adjustable settings, adjust and set as follows (short circuit, coordination, and arc flash report is NOT required if all new circuit breakers are fixed with no adjustable settings). Set adjustable continuous current settings (where applicable) to ratings shown on drawings. For adjustable instantaneous, short time, and ground fault settings (where applicable), the electrical contractor is responsible for (include all costs) a short circuit, coordination, and arc flash study performed by the respective circuit breaker manufacturer. Set breakers and label all associated electrical equipment as per this study. Provide study in accordance with applicable ANSI and IEEE standards. Gather all information required by the manufacturer to perform this study. Submit a written report of the study to the engineer for review prior to releasing equipment for manufacture. The coordination study may be limited to a minimum of coordinating each adjustable setting circuit breaker with the nearest line side overcurrent device directly feeding the breaker and all nearest load side overcurrent device(s) fed directly by the breaker. The short circuit study and arc flash study is required for all electrical equipment containing new circuit breakers which include or facilitate adjustable settings, for all equipment fed from ("downstream of") new circuit breakers which include or facilitate adjustable settings, for all equipment which feeds ("upstream of") new circuit breakers which include or facilitate adjustable settings back to

all utility and/or generator source(s) (except that other unrelated equipment which branches off of "upstream" equipment is not required to be included in the study, unless specifically indicated otherwise), and as otherwise required to complete the coordination study and confirm proper settings. Setting adjustable circuit breaker settings to the minimum or factory "default" settings (i.e. as shipped from the factory) is not acceptable. Where the short circuit, coordination, and arc flash report is not submitted by the contractor or where devices are not set accordingly (for example, including where devices are set to the minimum or factory default settings) the electrical contractor may be held liable for nuisance tripping which may occur.

14. ENCLOSED CIRCUIT BREAKERS

14.1 Provide each enclosed circuit breakers consisting of a molded case circuit breaker, with a trip rating as indicated on the drawings, with provisions for padlocking in both the open and closed positions, within a listed enclosure manufactured for the purpose of housing a circuit breaker. Provide indoor breakers with NEMA-1 enclosures. Provide outdoor breakers with NEMA-3R enclosures.

14.2 Provide circuit breakers (including short circuit ratings) as specified elsewhere in this specification. Provide circuit breakers of the bolt-on type.

14.3 Provide enclosed circuit breakers with ground busses. Where neutral conductor is present, provide safety switches with separate neutral busses. Provide neutral bus with provisions for bonding and bond where required by the NEC.

14.4 Equipment as manufactured by ABB/GE, Eaton, Schneider, and Siemens (or equivalent) shall be considered.

15. BRANCH PANELS

15.1 Provide branch panels (panel boards) of dead front completely enclosed safety type construction, listed (with all components bearing labels), of a type suitable for use as service entrance, and containing thermal-magnetic "bolt-on" type circuit breaker branches as per the respective schedules on the drawings.

15.2 Provide circuit breakers as specified elsewhere in this specification.

15.3 Provide cabinets consisting of code gauge galvanized sheet steel boxes of sufficient depth, width, and length to mount the panels as indicated on the drawings and to facilitate wiring, with suitable lugs for mounting panel interiors, and with wiring gutters at top, bottom, and sides of sufficient size to adequately accommodate the raceways, conductors, and cables entering and leaving (provide all gutters at least 100 mm (4")).

15.4 Provide panel faces with adjustable indicating type clamps and of door-in-door construction, with inner door opening over the circuit breaker section and outer door over wiring space (both secured with locks and pulls as per specifications section "Locks and Keys"), hung with heavy hinges, and with faces and doors not less than 2.7 mm (12 ga.) thick.

15.5 Provide metal frame circuit directory holders welded to the inside of the cabinet doors with transparent covers. Place typewritten directories in these holders.

15.6 Provide bus bars with ampacity as indicated on the drawings (or corresponding to main breaker, where applicable) and with all current carrying parts sized per UL 67 heat rise testing.

15.7 Provide panels with copper or aluminum bus bars.

15.8 Provide panels with separate ground and neutral busses. Provide neutral bus with provisions for bonding and bond where required by the NEC.

15.9 Provide panels with 10,000 A short circuit rating (A.I.C., I_{sc}), unless indicated otherwise on the drawings. Provide panels fully short circuit rated, series short circuit rating of panels are not acceptable (unless specifically indicated otherwise).

15.10 Equipment as manufactured by ABB/GE, Eaton, Schneider, and Siemens (or equivalent) shall be considered.

15.11 Where indicated on the drawings or required by code, provide with integral factory installed transient voltage surge suppression (TVSS). Provide for all emergency panels whether shown on not on drawings.

15.12 Where branch wiring fed from the panel utilizes cable wiring methods (i.e. types "AC" or "MC" cables, where permitted elsewhere by the specifications) avoid visible exposed cables in electrical closets and electrical rooms by either of the following options:

A. Provide suitable sheet metal panel "skirt" enclosure(s) above and/or below the panel to completely enclose cable wiring methods so not more than a 300 mm (12") total length of each cable is visible. Provide skirt enclosures fabricated of galvanized sheet steel not less than 0.55 mm (26 ga.) thick.

B. Provide a nearby junction box for branch wiring as indicated below.

15.13 Where panels are flush mounted, provide an adjacent junction box for branch wiring as indicated below.

16. JUNCTION BOXES FOR BRANCH PANELS

16.1 Provide suitable junction boxes (and/or wiring troughs) for branch wiring at branch panels as follows. The electrical contractor must provide junction boxes for all flush mounted panels. The electrical contractor may utilize junction boxes (as an option to metal panel skirts) to avoid exposed visible cables in electrical closets and electrical rooms. The electrical contractor may utilize junction boxes at other locations and applications if desired, but the boxes and raceways (wherever used) must comply with all of the following requirements.

16.2 Locate each junction box above an accessible drop ceiling (or an access panel if ceiling is inaccessible) directly above or as close as practical to the panel. Where junction box is installed to satisfy requirements to hide cable wiring methods, locate outside of the

electrical closet/room or inside the closet/room at a perimeter wall so there are no visible cables in the closet/room (except that not more than 300 mm (12") total visible length of each cable is permitted leaving the junction box).

16.3 Provide junction boxes and raceways between boxes and panel as indicated below.

Panel Size (Branch Cct. Poles)	Junction Box Min. Dimensions	Quantity and Size of Conduits
43-Poles & Over (All Double panels)	48"W x 8"H x 8"D (1.2m x 205mm x 205mm) *	(8) 53 mm (2")
31-to 42-Poles	24"W x 8"H x 8"D (0.6m x 205mm x 205mm)	(4) 53 mm (2")
19-to 30-Poles	24"W x 6"H x 6"D (0.6m x 155mm x 155mm)	(3) 53 mm (2")
18-Poles and less	18"W x 6"H x 6"D (460mm x 155mm x 155mm)	(2) 53 mm (2")

* Two (2) 24"W x 8"H x 8"D (0.6 m x 205 mm x 205 mm) junction boxes may be substituted. Provide (2) 78 mm (3") conduit nipples between the junction boxes.

16.4 Adjust wiring sizes between each junction box and panel in accordance with NEC de-rating factors. Utilize #8 AWG wiring for branch circuits rated 25 A or 30 A. Utilize #6 AWG wiring for branch circuits rated over 30 A but less than 60 A. Coordinate routing of wiring between junction box and panel with the engineer during construction for all circuits rated over 30 A. Where wiring sizes change due to de-rating considerations, splice wiring in the junction box.

16.5 Do not pass the incoming panel feeder and any branch circuits rated 60 A and larger through junction boxes, run this wiring directly into panels. Do not terminate any branch wiring conductors (including grounding conductors associated with each branch circuit) in junction boxes. Terminate conductors only at circuit breakers, ground bus, and neutral bus in panels. Do not splice conductors in junction boxes, except straight-through splicing of two (2) conductors as provided above for de-rating.

16.6 Bond each junction box to the panel enclosure with a grounding conductor run in one of the raceways between the panel and junction box. Provide bonding conductor not smaller than the grounding conductor for the panel feeder.

17. DISTRIBUTION PANELS

17.1 Distribution panel (distribution panel boards and switchboards) specifications are based on Schneider "I-Line" type. Additional equipment including ABB/GE "AV-Line" type and "Spectra" series, Eaton "Pow-R-Line" type, Schneider #QED type, and Siemens "P-series" (or equivalent) shall be considered.

17.2 Provide distribution panels of dead front completely enclosed safety type construction, listed (with all components bearing labels), and of a type suitable for use as service entrance.

17.3 Provide thermal-magnetic branch circuit breakers featuring "bolt-on" type modular mounting, facilitating mounting of breakers regardless of breaker frame sizes or poles.

17.4 Provide circuit breakers as specified elsewhere in this specification.

17.5 Where new "spaces" or "provisions" for circuit breakers are indicated on the drawings or specifications, include all circuit breaker mounting brackets, hardware, bus bar straps, screws, and any other material, equipment, and accessories required to install circuit breakers in the future (install in panel spaces). Provide so the only necessary component not furnished as part of provisions is the circuit breaker(s) themselves.

17.6 The quantity of provisions (of each respective frame size) specifically indicated on the drawings is the minimum acceptable. If necessary, provide additional branch distribution sections to provide the specified minimum quantity. After satisfying specified minimums, provide additional provisions (of 100 AF, 225/250 AF, and/or 400 AF frame sizes; in any combinations at the manufacturer's/contractor's discretion) so all remaining available circuit branch breaker mounting space in the panel (for the full height of the panel enclosure) consists of provisions.

17.7 Provide all compartments (and all main and branch circuit breakers and other equipment therein) completely accessible from the front, unless otherwise indicated on the drawings (regardless if panels are shown against a wall or free-standing).

17.8 Provide enclosure consisting of code gauge steel box(es) of galvanized sheet steel of sufficient dimensions to mount panels and to facilitate wiring.

17.9 Provide bus bars with ampacity as shown on the drawings (or matching main breaker, where applicable) and with all current carrying parts sized per UL 67 heat rise testing.

17.10 Provide panels with copper or aluminum bus bars.

17.11 Provide panels with separate ground and neutral busses. Provide neutral bus with provisions for bonding and bond where required by the NEC.

17.12 Provide bus bars braced to withstand 100,000 A short circuit current. Provide panels with 100,000 A short circuit rating (A.I.C., I_{sc}), unless indicated otherwise on the drawings (rating on drawings does not apply to bus bracing, provide bracing as indicated above). Provide panels fully short circuit rated, series short circuit rating of panels is not acceptable.

17.13 Identify each branch circuit breaker individually with an engraved plastic nameplate as indicated in the section of this specification "Identification, Nameplates and Tags".

17.14 Where indicated on the drawings, provide panels with integral factory fitted electronic metering units with appropriate metering transformers. Provide metering units to meter current (in all three phases), voltages (phase-to-phase and phase-to-neutral/ground in all three phases), power (kW), apparent power (kVA), energy consumption (kWH), power factor, peak demand power (kW peak), and harmonic THD and K-factor, and featuring true RMS metering. Provide meter with communications capability via RS-485 port and via Ethernet (10/100 Base-T UTP) communications card. Provide a telephone/data outlet (see symbol list on drawings) at panel (whether shown on the drawings or not). Provide metering units as Schneider/Power Logic #PM820 (with #PM8ECC communications card, ABB/GE, Eaton, Siemens, or approved equal).

17.15 Where indicated on the drawings or required by code, provide equipment ground fault protection for main and/or branch circuit breakers.

17.16 Where indicated on the drawings or required by code, provide with integral factory installed transient voltage surge suppression (TVSS). Provide for all emergency panels whether shown on not on drawings.

17.17 Where draw-out construction or draw-out circuit breakers are shown on the drawings or otherwise specifically noted, provide panels accordingly. Refer to the section of this specification "Unit Substation" for information.

18. DRY TYPE TRANSFORMERS

18.1 Provide dry type transformers (indicated "AA" on the drawings) with primary and secondary voltages, connections (i.e. single phase, three-phase wye, three-phase delta, etc.), and kVA rating as indicated on the drawings.

18.2 Provide with 150 degrees C temperature rise above 40 degrees C ambient. Provide all insulating materials in accordance with NEMA St20-1972 standards for a 220 degree C listed component recognized insulation system and provide transformers listed for the specified temperature rise. The maximum temperature of the top of the enclosure may not exceed 50 degrees C rise above 40 degrees C ambient.

18.3 Provide with primary full capacity taps, a minimum of two (2) 2.5% taps above and two (2) 2.5% taps below rated voltage.

18.4 Provide coils of continuous wound construction impregnated with non-hydroscopic, thermosetting varnish. Provide copper or aluminum coil windings.

18.5 Provide core constructed of high grade, grain oriented, non-aging silicon steel laminations with high magnetic permeability, featuring low hysteresis losses and low eddy current losses, and constructed to maintain magnetic flux densities well below the saturation point. Provide core laminations clamped together with structural steel angles. Provide the core and coil fastened to the enclosure base utilizing an appropriate engineered permanent fastening and vibration isolating/absorbing system (i.e. including rubber mounts). Metal-to-metal contact of any kind between the core and coil and the enclosure is not acceptable. Isolating systems requiring the complete removal of all fastening devices are not acceptable. Provide core and all ferrous parts suitably protected to resist corrosion by painting or plating.

18.6 Provide core visibly grounded to the enclosure by means of a flexible grounding conductor sized in accordance with applicable NEMA, IEEE, and ANSI standards.

18.7 Provide transformers mounted in heavy gauge, sheet steel, ventilated enclosures designed for floor mounting or designed for both floor and wall mounting (wall mounting only is not acceptable, unless specifically indicated on the drawings). Provide ventilating openings to prevent access to live parts in accordance with UL, NEMA, and NEC standards (specifically including NEC Articles 110.27 and 450.8 [and 110.31(B)(1) if over 600 V]) for ventilated enclosures in locations accessible to unqualified persons (whether installed in such locations or not), including the use of an enclosure bottom plate (open bottom is not acceptable under any circumstance). Include custom/special enclosures or enclosure

modifications to satisfy this requirement (where enclosures are installed which not meeting this requirement [without prior written approval], the contractor shall remove the enclosure and provide a new acceptable enclosure at no cost to the owner).

18.8 Provide the entire enclosure degreased, cleaned, phosphatized, primed, and finished with gray baked enamel.

18.9 Provide manufacturer guaranteed sound levels not exceeding 45 dB.

18.10 For transformer coils rated 600 V and less, provide basic impulse level (B.I.L.) rating as per applicable industry standards. For transformer coils rated over 600 V, provide 95 kV B.I.L. rating.

18.11 Provide all transformers rated 15 kVA and larger as energy efficient NEMA TP1 rated. Provide all transformers rated 480V-3PH-3W to 120/208V-3PH-4W and 500 kVA and less with UL K-13 rating, minimum, unless specifically indicated otherwise.

18.12 Where transformers are indicated as part of a unit substation, provide with suitable coordinated flanges for assembly to high voltage and low voltage compartments. Provide all hardware, bus, connectors, etc. for complete assembly.

18.13 Where transformers are indicated with forced-air cooling ("AA/FA" on the drawings) provide complete with integral cooling fans, automatic fan controls, and integral control power transformer for fans. Provide forced-air cooling for increased capacity 33.3% above the base (AA) transformer rating. Provide automatic fan controls including over temperature alarm with indicating light and horn and with contacts for external monitoring. Provide nameplate reflecting fan rating.

18.14 Where transformers are indicated with provisions for future forced air cooling ("AA/FFA" on the drawings) provide with core and coils rated based on future addition of fans, with integral provisions for mounting future cooling fans, with blank plate in enclosure as provisions for mounting future fan controls, and provisions for connecting future control power transformer. Provide all required heat sensing equipment installed in transformer coils. Future forced-air cooling shall provide increased capacity 33.3% above the base (AA) transformer rating once fans are installed. Provide nameplate reflecting future fan rating.

18.15 Equipment as manufactured by ABB/GE, Eaton, Schneider, Siemens, and Sola (or equivalent) shall be considered.

19. CONTACTORS AND OUTDOOR LIGHTING CONTROLS

19.1 INTEGRATED OUTDOOR LIGHTING CONTROLLER: Provide integrated outdoor lighting controller of the combination photocell and time clock type as shown below (unless other type(s) are specifically indicated on the drawings). Provide lighting contactors, time clocks, fusing, and remote photocells as indicated in respective sections elsewhere in this specification. Provide an engraved laminated plastic nameplate on the front cover (refer to the section of this specification "Identification, Nameplates, and Tags") describing the controller ("OUTDOOR LIGHTING CONTROLLER - 120V, 5A - CONTROLS FED FROM PP1 - CCT. 4 - SEE INSIDE FOR CONTROLLED CIRCUITS -

PHOTOCELL ON ROOF AT NORTH SIDE OF BUILDING"). Describe the location of the remote photocell, where applicable. Provide engraved laminated plastic nameplates at each switch indicating the switch function and respective switch positions. Provide engraved laminated plastic nameplates at each pilot light indicating the light function. Switch/pilot light nameplates may utilize 1/8" letters. Provide a typewritten circuit directory affixed within the enclosure listing each respective contactor pole, panel, circuit number, and description of each controlled circuit. Equipment as manufactured by ABB/GE, ASCO/Schneider, Eaton, Schneider, and Siemens (or equivalent) shall be considered.

A. Combination Photocell and Time Clock Lighting Controller: Provide combination photocell and time clock controlled integrated outdoor lighting controller including two (2) 20 A, 12-pole lighting contactors (one (1) for photocell and time clock lighting and one (1) for photocell only lighting), an integral one (1) channel digital time clock, two (2) hand-off-auto (HOA) selector switches (one (1) for each lighting contactor above), suitable terminal blocks for all field wiring (including 120 VAC incoming controller power wiring, connections to remote photocell, etc.), fused (rating as per manufacturer) control power circuit, and complete factory internal wiring. Provide all components above enclosed within an overall NEMA-1 enclosure with hinged cover and locking (keyed to match branch panel keys) hasp (provide HOA switches mounted on the front cover). Provide ASCO/Schneider #641AS outdoor lighting controller (or approved equal).

B. Photocell Only Lighting Controller: Provide photocell controlled integrated outdoor lighting controller including one (1) 20 A, 12-pole lighting contactor, one (1) hand-off-auto (HOA) selector switch, suitable terminal blocks for all field wiring (including 120 VAC incoming controller power wiring, connections to remote photocell, etc.), fused (rating as per manufacturer) control power circuit, and complete factory internal wiring. Provide all components above enclosed within an overall NEMA-1 enclosure with hinged cover and locking (keyed to match branch panel keys) hasp (provide HOA switches mounted on the front cover). Provide ASCO/Schneider #641S outdoor lighting controller (or approved equal).

C. Time Clock Lighting Controller: Provide time clock controlled integrated outdoor lighting controller including one (1) 20 A, 12-pole lighting contactor, an integral one (1) channel digital time clock, one (1) hand-off-auto (HOA) selector switch, suitable terminal blocks for all field wiring (including 120 VAC incoming controller power wiring, connections to remote photocell (where applicable), etc.), fused (rating as per manufacturer) control power circuit, and complete factory internal wiring. Provide all components above enclosed within an overall NEMA-1 enclosure with hinged cover and locking (keyed to match branch panel keys) hasp (provide HOA switches mounted on the front cover). Provide ASCO/Schneider #641A outdoor lighting controller (or approved equal). Where a photocell is indicated on the drawings, provide complete interconnections between controller and photocell. Where a photocell is not indicated on the drawings, provide a field jumper in place of photocell contact connection.

D. Lighting Controller Emergency Contactor: Provide outdoor lighting controller including an electrically held emergency lighting contactor in a separate NEMA-1 enclosure to control emergency outdoor lighting. Maintain complete separation between normal and emergency source wiring as per code. Provide emergency

lighting contactor consisting of a 20 A, 12-pole electrically held and electrically operated (mechanically held contactor of any type is not acceptable for emergency use) lighting contactor with all normally closed (N.C.) contacts so emergency lighting circuits energize upon loss of control voltage to this contactor. Interconnect emergency contactor with a normally closed auxiliary contact in the normal photocell controlled lighting contactor wired in series with an auxiliary contact in the generator automatic transfer switch (contact opens when generator is in the "emergency" position). Provide all interconnecting field wiring.

19.2 LIGHTING CONTACTORS: Provide lighting contactors with number of poles and ampere ratings as indicated on the drawings. Provide contactors mechanically held and electrically operated with integral solid-state control modules for two (2) wire control, unless indicated otherwise. Utilize electrically held and electrically operated contactors only where specifically indicated on the drawings (and provide with not less than one (1) N.C. and one (1) N.O. auxiliary contacts). Provide contactors with silver alloy double break contacts, with all contacts rated 600 V, and with coil clearing contacts. Provide 120 VAC coil voltage, unless indicated otherwise. Provide contactors mounted in NEMA-1 enclosures, unless indicated otherwise. Provide all contacts normally open, unless indicated otherwise.

A. Provide an engraved laminated plastic nameplate on the front cover (refer to the section of this specification "Identification, Nameplates, and Tags") describing the contactor ("OUTDOOR LIGHTING CONTACTOR - 120V, 5A - CONTROLS FED FROM PP1 - CCT. 4 - SEE INSIDE FOR CONTROLLED LIGHTING CIRCUITS - *"). Describe the device(s) controlling the contactor and controlling device(s) location(s), where applicable. Provide a typewritten circuit directory affixed within the enclosure listing each respective contactor pole, panel, circuit number, and circuit description of each controlled circuit. Nameplate is not required for contactors integral to a lighting controller where the controller includes a similar nameplate.

B. Provide contactors rated 20 A as ASCO/Schneider #918 series (or approved equal). Provide contactors rated 30 A and larger of the non-fusible combination type, with integral disconnect switch, Schneider Class #8903 type "S" (or approved equal). Equipment as manufactured by ABB/GE, ASCO/Schneider, Eaton, Schneider, and Siemens (or equivalent) shall be considered.

19.3 TIME CLOCKS: Provide one (1), two (2), or four (4) channel time clocks, as indicated on the drawings. Provide time clocks with one (1) single pole, double throw (SPDT) contact for each respective channel (to facilitate control of mechanically held, electrically operated contactors), with digital control (electromechanical type is not acceptable), of the seven (7) day type with 365 day single and block holiday scheduling, with astronomic feature, indicating "on" or "off" condition with an illuminated light emitting diode (LED) visible with the enclosure cover open, with integral manual override capability, with integral automatically recharging nickel cadmium (NiCd) battery providing minimum 72 hour reserve power. Provide coil and contact voltage rated 120 V, unless indicated otherwise. Provide time clock with NEMA-1 metal or NEMA-3 "Noryl" enclosure, unless indicated otherwise. Provide contacts rated 20 A where directly switching branch circuit load or rated 10 A (resistive) minimum where controlling contactor(s). Utilize Tork #DZS100BP (one channel), #DZS200BP (two channel), or #K400Z (four channel) time clocks (or approved equal). Provide an engraved laminated plastic nameplate on the front cover of each time clock (refer to the section of this specification "Identification, Nameplates, and

Tags") describing the time clock ("OUTDOOR LIGHTING - 120V, 5A - CONTROLS FED FROM PP1 - CCT. 4 - SEE INSIDE FOR CONTROLLED LIGHTING CIRCUITS - *"). Describe the device(s) controlled by the time clock and controlled device(s) location(s), where applicable. Where time clock switches branch circuits directly, provide a typewritten circuit directory affixed within the enclosure listing each respective contact pole, panel, circuit number, and circuit description of each controlled circuit. Nameplate is not required for time clocks integral to a lighting controller where the controller includes a similar nameplate. Specifications are based on equipment as manufactured by Tork. Equipment as manufactured by Intermatic and Paragon (or approved equal) shall be considered.

19.4 PHOTOCELLS: Provide photocells of the utility-grade twist-lock type with integral time delay feature (nominal 3-5 s), with molded sealed infrared (IR) silicon electronic sensor and 360 J integral utility grade metal oxide varistor (M.O.V.) over-voltage surge protection, arranged to "fail-on", listed, and rated 120-305 V (suitable for 120 V, 208 V, 240 V, and 277 V operation), 1,000 W tungsten, 1,800 VA ballast, and 1,000 W LED, unless indicated otherwise. Provide a suitable twist-lock photocell receptacle and mount atop a suitable weatherproof box. Utilize Tork #5237M photocells and Tork #2223/4 photocell twist-lock receptacles (or approved equal). Provide an engraved laminated plastic nameplate at photocell twist-lock receptacles (refer to the section of this specification "Identification, Nameplates, and Tags") describing the device(s) controlled by the photocell and the circuit feeding the photocell ("SEE LIGHTING CONTROLLER IN ELECTRICAL ROOM - 120V, 5A - PP1, CCT. 4"). Nameplate may utilize 3.2 mm (1/8") letters. Specifications are based on equipment as manufactured by Tork. Equipment as manufactured by Intermatic and Paragon (or approved equal) shall be considered.

20. PRIMARY CABLE AND TERMINATIONS

20.1 Provide primary cable, terminations, and splices as indicated on the drawings. Provide cable of a type approved by the utility company. Provide as 105 degrees C rated type "MV-105" cable (90 degrees C type "MV-90" may be considered where type "MV-105" is not included in manufacturer's standard catalogs for the cable style specified) utilizing ethylene propylene rubber (EPR) insulating material only, unless indicated otherwise on the drawings. Where specifically indicated on the drawings only, tree-retardant cross-linked polyethylene (XLP) insulating material is permitted; XLP insulated cable other than tree-retardant type is not acceptable under any circumstance.

20.2 Submit shop drawings of primary cable, terminations, and splices for review and approval. Where the contractor installs cables, terminations, or splices not meeting all requirements of the drawings and specifications (without prior written approval), the contractor shall remove the cables and install new cables of the specified type (including all splicing and terminations) at no cost to the owner.

20.3 Provide splices and terminations conforming with the section of this specifications "Splices, Taps, and Connections", except as modified below. Provide splices and taps insulated to a voltage level equaling or exceeding the cable voltage rating. Provide all splices and terminations utilizing crimp-on compression lugs and connectors. Bolted pressure type connections of any kind are not acceptable under any circumstance. Provide splices and terminations suitable for 105 degrees C (compatible with "MV-105" cable and facilitating use of NEC 105 degrees C ampacity determination).

20.4 Provide terminations where required including complete connections to equipment as per the cable manufacturer and the equipment manufacturer and in accordance with utility company standards. Provide termination types and manufacturers as directed and approved by the cable manufacturer and the utility company. Utilize only manufactured or pre-engineered terminations specifically designed and listed for the application. Provide outdoor exposed terminations as suitable for installation in wet locations and sunlight resistant. Pre-molded, heat-shrink, and cold-shrink manufactured kits and engineer approved pre-engineered hand-wrapped tape kits shall be considered. Verify all requirements prior to ordering materials.

20.5 Avoid splices as much as practical in primary cables. Splices are not permitted under any circumstance except where specifically indicated on the drawings or impossible to otherwise install cable. Where required, provide splice types and manufacturers as directed and approved by the cable manufacturer and the utility company. Utilize only manufactured or pre-engineered splices specifically designed and listed for the application, including being suitable for installation underground, direct buried, submerged, and in wet locations. Provide outdoor exposed splices also as sunlight resistant. Pre-molded, heat-shrink, and cold-shrink manufactured kits and engineer approved pre-engineered hand-wrapped tape kits shall be considered. Verify all requirements prior to ordering materials.

20.6 Provide primary cable fire protection where two (2) or more primary feeders are present in the same manhole, hand hole, box, or enclosure, where cables are installed in pull or junction boxes within buildings, and where specifically indicated on the drawings. Provide fire protection by wrapping all visible portions of cables with non-asbestos expanding elastomer fire and electric arc resistant tape and then over-wrap with glass cloth electrical tape (to bind in place). Install in complete accordance with tape manufacturer's instructions and recommendations. Individually wrap each feeder; wrapping two (2) or more different feeders together with common tape is not acceptable. Where the three (3) phase cables of a feeder are bundled together, wrapping common tape around bundled cables is permitted. Where cables of a feeder are separated and for all splices, individually wrap each cable/splice.

END OF SECTION

SECTION 16400 - LIGHTING SYSTEM

1. GENERAL PROVISIONS

1.1 The applicable requirements and conditions of specifications section "General Provisions" of specifications divisions 16100, General Electrical, and 16300, Electrical Materials, are hereby made an integral part of this section.

1.2 Provide lighting systems consisting of all components necessary for a complete installation. Refer to the lighting fixture/luminaire schedule on the drawings for additional information.

1.3 Luminaires including, but not limited to, those manufactured by the following shall be considered: Abolite, Cooper, Columbia, Contech, Elliptipar, Emergilite, GE Lighting, Hubbell, Insight, Kenall, Kim, Kirlin, Kurt Versen, Light Guard, Lightolier, Lithonia, LSI, Prescolite, Sim-Kar, Sterner, Stonco, Tivoli, Williams, Winona, and ZSLI (or approved equal).

2. DRIVERS, BALLASTS, AND WIRING

2.1 Completely coordinate exact lamp types (including configuration, dimensions, bases, pins, etc.), drivers, ballasts, starters, capacitors, sockets, luminaire construction and arrangement (as related to facilitating lamps and related equipment), and all applicable ancillary equipment and provide a complete and compatible installation.

2.2 Submit shop drawings of all drivers/ballasts proposed for use (multiple manufacturers and series are permitted, provided all drivers/ballasts conform to the specifications). Where luminaires are installed by the contractor which include drivers/ballasts that do not meet the specifications (without prior written approval) the contractor shall remove drivers/ballasts and provide new drivers/ballasts meeting the specified criteria at no cost to the owner.

2.3 Provide all drivers/ballasts of the high power factor solid-state electronic energy saving type, unless indicated otherwise on the drawings. Low power factor drivers/ballasts are not permitted unless specifically indicated on the drawings. Magnetic or any other type drivers/ballasts not identified/listed as energy saving type are not permitted under any circumstance. "Hybrid" or magnetic energy saving types are not permitted unless specifically indicated on the drawings.

2.4 Provide luminaires installed outdoors, in garages, or wherever "cold weather" drivers/ballasts are indicated on the drawings with -18 degrees C (0 degrees F) maximum rated cold weather solid state electronic energy saving drivers/ballasts, unless indicated otherwise.

2.5 Multiple-lamp luminaires may utilize quantity of drivers/ballasts at the contractor's discretion (i.e. one (1) multiple-lamp driver/ballast or several 1- or 2-lamp drivers/ballasts), unless indicated otherwise.

2.6 For lighting controlled by "dual switching", provide with two (2) separate drivers/ ballasts to facilitate switching. For "dual switched" three-lamp and four-lamp luminaires, provide internal wiring so the first switch controls inboard lamp(s) and the second switch controls outboard lamps. For "dual switched" two-lamp luminaires, provide internal wiring so the

first switch controls the "left side" lamp and the second switch controls the "right side" lamp. For one-lamp luminaires, multiple lamp luminaires available only with a single driver/ballast, and other luminaires where unable to wire lamps separately which are controlled by "dual switching", connect to one (1) of the two (2) switches as directed by the engineer during construction (coordinate with the engineer prior to rough-in). Where branch wiring serving lighting controlled by "dual switching" installed by the contractor does not comply with the above, the contractor shall modify or remove and reinstall wiring to provide proper switching at no cost to the owner. Where luminaires controlled by "dual switching" are installed by the contractor and do not have drivers/ballasts and/or internal wiring to comply with the above, the contractor shall modify or replace drivers, ballasts, internal wiring, and/or the luminaires to provide proper switching at no cost to the owner.

2.7 For lighting shown with 0-10 V dimming, provide with drivers/ballasts to facilitate dimming. For all light types shown or specified with 0-10 V dimmable drivers/ballasts (wherever 0-10 V dimming is indicated on the drawings [including luminaire schedule] or specifications), provide both power wiring and 0-10 V control wiring to all luminaires. Run control wiring from all lights with 0-10 V dimmable drivers/ballasts to the respective dimmer or switch controlling the lighting. Where dimmers are shown on the drawings (including combination sensors/dimmers), interconnect control wiring with dimmers as per manufacturer. Where dimmers are not shown on the drawings, install control wiring to the switch (non-dimmed) location and safely insulate and cap off control wiring (to facilitate future replacement of non-dimmed switch with dimmer).

3. LAMPS (LIGHT ENGINES)

3.1 Provide all lamps (the term "lamp" includes all light engines of any type which directly emit illumination) as follows. Completely coordinate exact lamp types (including configuration, dimensions, bases, pins, etc.), ballasts, drivers, starters, capacitors, sockets, luminaire construction and arrangement (as related to facilitating lamps and related equipment), and all applicable ancillary equipment and provide a complete and compatible installation.

3.2 Provide lamps for luminaires as indicated on the drawings. Provide all luminaires with lamps (even if lamp types and/or quantities are not shown on drawings) to provide a complete installation.

3.3 Acceptable lamp manufacturers include GE Lighting, Osram/Sylvania, and Philips (or approved equal).

3.4 Maintain compatibility and consistency of lamp types and manufacturers (as well as lamp colors, except where different lamp colors are indicated on the drawings) throughout the project as much as possible. Provide luminaires so lamps are completely interchangeable between different luminaire types shown on the luminaire schedule with the same type lamps, wherever possible. For each combination of lamp type and color utilized on the project, provide all lamps of a single manufacturer. Different manufacturers are permitted for different lamp type and color combinations. Utilizing more than one (1) manufacturer for any lamp type and color combination is not permitted (except where specifically approved in writing by the engineer and owner).

3.5 Provide all lamps (of all types) of the energy saving light emitting diode (LED) type, unless specifically indicated otherwise on the drawings. Lamps which are not energy saving LED are not permitted (unless specifically approved in writing by the owner, architect, and engineer. Provide all lamps of a type suitable for use ("burning") in any position (unless specific burning positions are indicated on the drawings).

3.7 Provide screw-in lamps where indicated on the drawings and as specified below. Provide of the medium base type, unless indicated otherwise. Utilize only LED.

A. Provide all A-lamps of the energy saving LED type.

B. Provide all PAR-lamps and R-lamps of the energy saving LED type. Provide standard flood beam spread ("FL") unless indicated as "NFL" (narrow flood), "SP" (spot), or "NSP" (narrow spot), or as otherwise indicated in the luminaire schedule.

C. Provide all MR-lamps of the energy saving LED type. Provide standard flood beam spread ("FL") unless indicated as "NFL" (narrow flood), "SP" (spot), or "NSP" (narrow spot), or as otherwise indicated in the luminaire schedule. For LED, provide of a type with no ultraviolet (UV) emissions.

4. LUMINAIRES

4.1 Provide luminaire types and manufacturers as indicated on the drawings. Where a luminaire type designation (i.e. letter) is not shown at a luminaire symbol, include costs in bid to provide any applicable type of luminaire used for the same symbol anywhere else on the drawings.

4.2 Support all luminaires (including outlet boxes and/or conduits used to support luminaires, where permitted) in complete accordance with all applicable requirements of the NEC (including, but not limited to, code requirements for mounting and support of luminaires, outlet and other boxes, conduits, raceways, and devices). Provide all required mounting hardware, including pendant kits, fasteners, hangers, wall mounted brackets, concrete foundations, conduits, supplementary supports, grounding, etc., for a complete installation. Support all luminaires completely independent of suspended ceilings and direct from the structure (suspended ceilings are permitted to provide supplemental lateral support to luminaires which are vertically supported direct from the structure), except as follows. Luminaires are permitted to be supported from/by suspended ceilings only where both the general contractor's suspended ceiling installation and the electrical contractor's method of securing luminaires to the suspended ceiling are in complete accordance with NEC requirements for supporting luminaires. Supporting luminaires with or from conduits or raceways is not permitted, except that luminaires specifically designed for conduit support may be supported utilizing only rigid steel conduit (supporting with any other type conduit or raceway, including IMC, EMT, PVC, surface raceway, and flexible conduit, is not permitted under any circumstance). Supporting luminaires from screw shells of lamp holders is not permitted under any circumstance. Supporting luminaires or wiring from trees or vegetation is not permitted under any circumstance.

4.3 Refer to architectural drawings, reflected ceiling plans, and details for exact locations of all luminaires. Verify final location of all luminaires with the owner, architect, and lighting designer (where applicable) prior to rough-in.

4.4 Perform field measurements, verify proper clearances, and verify all exact mounting and installation conditions and requirements prior to ordering luminaires.

4.5 Provide integral thermal protection for all recessed luminaire housings.

4.6 Perform aiming of all adjustable interior luminaires. Include all costs to aim to the satisfaction of the owner, architect, and engineer. This aiming may be performed during normal working hours.

4.7 For surface mounted luminaires wired utilizing surface mounted wiring methods, provide wiring entering the side of luminaires. Where fixtures do not facilitate side entry of wiring, provide fixture with manufacturer's back mounting adapter (so wiring enters side of adapter and then enters rear of fixture by passing through adapter). Installing the fixture on surface outlet boxes (in such a way that there is a significant "gap" between the fixture and the wall/ceiling surface) is not acceptable.

4.8 Wherever finish colors are indicated on the drawings (including symbol list and luminaire schedule) as being selected by the architect ("as per architect", etc.), include costs in bid to utilize any of the available standard and/or optional colors listed in manufacturers' catalogs (excluding any colors identified in manufacturers' catalogs as "custom" or "premium").

4.9 Where luminaires are specified or furnished by the contractor with tamper resistant hardware (including, but not limited to, torx, spanner, allen/torx with center reject pin, etc.) which must be removed in order to access lamps or drivers/ballasts for replacing or servicing, furnish and turn over to the owner not less than two (2) tamper resistant screw drivers of each type required.

4.10 Where track lighting, continuous linear lighting, and similar luminaires are indicated on the drawings, provide complete and coordinated installation. Install in continuous lengths with even appearance as shown on the drawings utilizing general sections as shown on the drawings (or if not shown as otherwise required and available from the manufacturer). Include all joining/extension fittings (corners, tees, crosses, straight extensions, etc., with lens and/or louver where applicable), end caps, aligning/attaching hardware, ceiling flanges, grid rails, yokes, etc. (where applicable). For luminaires installed continuous between building members (walls, ceiling soffits, or other architectural structures and details), individually measure exact dimensions at each and every locations and order and install luminaires accordingly. Fully coordinate the installation with the architect and general contractor.

5. EXTERIOR LIGHTING

5.1 All provisions of the section of this specification "General Lighting" apply to exterior lighting as modified herein.

5.2 Provide all pole mounted and "bollard" type ground mounted luminaires with suitable concrete foundations complete with embedded (during pour) "J-hook" anchor bolts. Anchors installed or set after foundations are cast are not acceptable under any circumstance. Notify the owner, architect, and engineer after excavation and prior to

pouring concrete to facilitate inspection. Provide conduit mounted ground luminaires with conduit secured in minimum 300 mm x 300 mm x 300 mm (12" x 12" x 12") concrete poured below grade and embedding conduit 90 degree bends at luminaire locations. Provide embedded conduit bends, conduit exposed above grade, and conduit between embedded bends and the portion exposed above grade as rigid steel only.

5.3 Install luminaire poles and bollard luminaires on foundations utilizing leveling nuts (nuts above and below base); shims are not acceptable. Grout between the foundation and pole/bollard base utilizing suitable non-shrink mortar finished vertically to the outside of the base, with a drain hole. Where grouting is not required or recommended by the pole/bollard manufacturer, grouting may be omitted where pole base cover or bollard housing completely covers the space between foundation and base.

5.4 For all concrete pole and bollard foundations, submit shop drawings (based on foundations shown on the drawings) of exact foundation construction, fabrication, and characteristics. Base pricing on foundation dimensions below grade as shown on foundations detail(s) on the drawings. Dimensions below grade may be reduced from the width/diameter and depth dimensions shown on the detail(s) where approved by the lighting manufacturer and in accordance with structural foundation shop drawings. Prepare and submit structural foundation shop drawings (sealed by a registered professional engineer from the state where the project is located) showing that the foundation is sufficient to fully support the forces involved based on actual soil conditions present at each respective foundation location (whether or not dimensions are reduced). Provide soil boring test results at each foundation location. The electrical contractor is fully responsible for all costs associates with engaging the services of structural registered professional engineer and performing soil borings for this purpose.

5.5 For all luminaire poles and bollards, provide approved tags for wiring (inside hand holes, where applicable). Provide tags indicating the panel name and circuit number (or other source of feeder), and stating the voltage, phase, and amperes of the feeder. Provide feeder tags wording and layout similar to engraved plastic nameplates (see specifications section "Identification, Nameplates, and Tags" of specifications division 16300, Electrical Materials).

5.6 Perform night aiming of all adjustable exterior luminaires. Include all costs in bid (including overtime costs for work at night) to aim to the satisfaction of the owner, architect, and engineer.

6. EMERGENCY AND EXIT LIGHTING

6.1 Provide all emergency and exit lighting as indicated on the drawings.

6.2 Verify exact mounting, quantity of faces, and directional arrows of all exit signs prior to ordering.

6.3 Install all exit signs at general locations as shown on the drawings. Coordinate and obtain approval for exact locations with the architect and local authorities having jurisdiction before installation. Install exit signs to ensure they are completely and clearly visible from the entire covered areas and egress paths.

6.4 Perform aiming of all adjustable emergency luminaires. Include all costs to aim to the satisfaction of the owner, architect, engineer, and local authorities having jurisdiction. This aiming may be performed during normal working hours.

6.5 Wherever any battery units or battery packs are installed (including batteries integral to luminaires), connect power to the battery units/packs on the line side of all lighting and other control switches so it is impossible to de-energize by turning any switch off.

6.6 Where indicated on the drawings (see also the luminaire schedule), provide emergency luminaires with integral and/or field-installed driver/ballast generator transfer device with 0-10 V dimming bypass (BGTD). Provide as Philips/Bodine #GTDU (or equivalent). Provide incoming emergency source wiring from emergency panel to light as shown on drawings (3 #10, 3/4" C, unless otherwise noted). Provide incoming normal source wiring (with constantly energized un-switched "constant hot" conductor, switch controlled "switched hot" conductor, neutral conductor, and grounding conductor) run from the normal switch location to the first normal-only light controlled by the switch then to the driver/ballast generator transfer device at emergency luminaires (4 #12, 3/4" C, unless otherwise noted). Provide internal luminaire wiring run from generator transfer device to controlled driver/ballast within each emergency luminaire.

END OF SECTION

SECTION 16510 - FIRE ALARM SYSTEM MODIFICATIONS

1. GENERAL PROVISIONS

1.1 The applicable requirements and conditions of specifications section "General Provisions" of specifications divisions 16100, General Electrical, and 16300, Electrical Materials, are hereby made an integral part of this section.

1.2 Extent of fire alarm and detection system work is indicated on the drawings and schedules. Fire alarm work includes modifying the existing fire alarm system to facilitate new fire alarm devices as indicated on the drawings. Types of fire alarm and detection equipment includes the following:

A. Control panel modifications
B. Audio/visual horn/strobes and visual strobes
C. Manual pull stations
D. Smoke, heat, and other automatic fire detectors
E. Duct type smoke detectors
F. Fire suppression (i.e. sprinklers, etc.) system flow, tamper, pressure, and other supervisory switch connections
G. Magnetic door holders

1.3 Provide the fire alarm system (including operation, equipment, devices, wiring, installation, and manufacturer's representative services [programming, testing, adjustment, equipment start-up, as-built documentation, and operation and maintenance documentation and instructions]) in complete accordance with all applicable federal, state, and local codes and standards (including National Electrical Code (NEC), Institute of Electrical and Electronic Engineers (IEEE), National Fire Protection Association (NFPA), Underwriter's Laboratories (UL), Factory Mutual (FM), American National Standards Institute (ANSI), National Electrical Contractors' Association (NECA) "Standard of Installation", Americans with Disabilities Act (ADA), United States Department of Labor Occupational Safety and Health Administration (OSHA), all local authorities having jurisdiction, etc.). Provide fire alarm system controls and all new and existing system components (including devices, equipment, modules, interfaces, etc.) listed to operate together. Provide all signaling devices of an ADA approved type providing ADA approved audible and visual coverage throughout all areas of the project.

1.4 Specifications are based on equipment indicated on the Electrical Symbol List on the drawings. Only equipment matching and fully compatible with (including maintaining NFPA, UL, FM, and other applicable listings and approvals) the existing fire alarm controls will be considered. The electrical contractor is fully responsible for verifying all compatibility requirements and all exact existing devices in the field before submitting shop drawings and shall provide the system accordingly. Include all costs in bid. Manufacturer and catalog numbers of equipment indicate the type and quality of the equipment required.

1.5 Submit a list of local approved service vendors with shop drawings. Perform manufacturer's representative services (specifically including programming, testing, adjustment, equipment start-up, as-built documentation, and operation and maintenance documentation and instructions) throughout the entire duration of the project, up through final testing and acceptance of the system by the owner and local authorities having

jurisdiction, include all costs in bid. *No extra consideration, claims, charges, or compensation will be granted under any circumstance for manufacturer's representative services (including programming, testing, adjustment, equipment start-up, as-built documentation, and operation and maintenance documentation and instructions) during the project (specifically including where associated with changes to the scope of work, alternates, unit prices, allowances, etc.) performed before final testing and acceptance of the system.* Extra claims and/or compensation shall only be considered for changes which are initiated after final testing and acceptance of the system.

2. SUBMITTALS

2.1 Submit shop drawings including, but not limited to, shop drawings on equipment and devices (specifically showing manufacturers, model numbers, and listing information), rough in diagrams, detailed project-specific riser and wiring diagrams (specifically showing conductor/cable types and sizes), installation layout drawings (specifically showing locations of all equipment and devices on floor plans [drawn to scale], equipment, and wiring and information on ceiling height and construction [on architectural background plans which shall be made available to the contractor for this purpose], information showing ADA compliant signaling device audible and visual coverage (specifically show all audible device decibel (dB) and visual device candela (cd) settings), and specifically showing interfaces with all fire suppression systems [sprinklers, etc.]), installation instructions, written warranty, detailed zone or addressable device lists (showing each system point identifiable from the control panel and the associated numbered address and detailed description), sequence of operation, power supply wiring information, and power consumption/supply/battery sizing and voltage drop calculations. Submit quantity as indicated elsewhere in the specifications to the engineer for review and approval. In addition to submitting to the engineer, submit additional sets (quantity as per local authorities) to the local authorities having jurisdiction for review, approval, and permits.

2.2 Include all costs in bid associated with preparing and submitting shop drawing information. This includes sealing (by a registered professional engineer) diagrams if required by the local authorities having jurisdiction.

2.3 Upon project completion, submit operation and maintenance (O&M) manuals (include with other project O&M manuals). Submit at least three (3) original copies of all fire alarm system software.

2.4 Upon project completion, submit certification of the entire system to the owner and local authorities having jurisdiction.

3. FIRE ALARM AND DETECTION SYSTEMS

3.1 Provide all components of the system matching and maintaining current operation, functioning, and system arrangement for a complete installation.

3.2 Perform all modifications to maintain current fire alarm system operation and operation as per code.

3.3 The fire alarm riser diagram on the drawings is approximate as a general guide to system architecture and functioning. Quantities of devices shown on the riser are approximate. Provide exact quantities as specified (based on floor plan drawings, etc.).

3.4 Additional/Spare Devices: Include providing (furnish, install, and wire including manufacturer's representative services [programming, testing, adjustment, equipment start-up, as-built documentation, and operation and maintenance documentation and instructions]) additional devices (in addition to devices shown on drawings or otherwise required by specifications) as follows. Include at least of 10% (of the respective quantity of each type device specified or otherwise used on the project) of each respective type notification, initiation, supervisory, and control device from specifications section 16510-4 (excluding control panel and annunciator), but in no case less than a minimum of two (2) of each type device); where additional and/or spare device quantities greater than zero (0) are specifically shown on the drawings those quantities take precedence over the percentage above. Include 15.2 m (50'0") of the appropriate type of fire alarm wiring for each additional device. If additional devices are not completely used by the conclusion of the project (after final acceptance by the owner), turn any remaining additional fire alarm devices over to the owner as spares. Additional devices may be used at any time during the project, include all costs in bid.

3.5 Provide the following sequence of operation and functions for new initiating and signaling devices.

A. Fire Alarm Activation: Actuation of any initiating device (including manual pull stations, automatic smoke, heat, and other fire detectors [including duct detectors, except as specifically provided below], and fire suppression flow/activation switches, etc.) initiates a "fire alarm" and activates all fire alarm signaling, output, and notification devices (including, but not limited to, horns and strobes, elevator interfaces, HVAC equipment shut-downs, door releases, and central station and fire department alarm notification).

B. Trouble Alarm Activation: Any trouble conditions in the fire alarm system (including actuation of fire suppression system tamper/status supervisory switches) initiates a "trouble alarm" and activates central station (and fire department where required) trouble notification and an audio and visual signal at the control panel and remote annunciator (where applicable). "Trouble alarms" do not activate alarm signaling devices or output devices (do not activate elevator interfaces or door releases [or HVAC equipment shut-downs, except as specifically provided as follows]). Only where code officials specifically require in writing that duct smoke detectors NOT initiating a general "fire alarm", duct detectors shall initiate a "duct smoke supervisory alarm" audio and visual signal at the control panel and remote annunciator and activate appropriate central station (and fire department where required) trouble notification.

C. Elevator Interfaces: Provide detectors, devices, wiring, conduit, relaying, final connections, and associated equipment between fire alarm controls, elevator controls, and shunt trip devices for the functions below. Perform all connections at elevator controls under the supervision of the elevator supplier. Functions below summarize operation only. Provide exact operation in strict accordance with all applicable codes and standards (including fire and elevator codes) and as directed by local authorities

having jurisdiction. Functions shown are typical of each new elevator only (*except where updated/upgraded functions for existing elevators are specifically indicated on the drawings*). Provide individual and distinct signals from the fire alarm system to elevator controls for each of the following functions:

1) Recall, Designated Floor: Recall elevator to the "designated" level upon one (1) of the following two (2) options, as directed by the local authorities (contact local authorities and verify which option is required during construction, include all costs in bid):

   a) Option #1: Upon any "fire alarm"
   b) Option #2: Upon activation of elevator lobby (except the designated level, see below). See also shaft/machine room recall below.

2) Recall, Alternate Floor: Recall elevator to the "alternate" level upon activation of designated level elevator lobby smoke detector(s).

3) Recall, Shaft/Machine Room: Recall elevator to the designated level upon activation of elevator pit or elevator machine room smoke detector(s) (except as follows). Where the alternate level is above the designated level, recall to the alternate level upon activation of pit detector(s). Where the elevator machine room is located on the designated level, recall to the alternate level upon activation of machine room detector(s). This signal shall be made via a supervised relay having multiple output contacts to facilitate initiating the required elevator functions and to facilitate activating elevator indicating lights (lights and all wiring by the elevator supplier) indicating fire in the elevator shaft and/or machine room.

4) Shut-Down: Operate shunt trip device(s) to disconnect incoming power to elevator(s) upon either of the following.

   a) Heat Detectors: *Provide the following heat detectors (whether or not shown on the drawings), unless the use of sprinkler flow switches is specifically shown on electrical/fire protection drawings.* Provide location and quantity of heat detectors as follows (locations/quantity are not shown on drawings). Locate so there is a heat detector within 610 mm (2'0") of every sprinkler head. Utilize only heat detectors having minimum listed spacing rating of 7.6 m (25'0") and lower temperature rating and higher sensitivity (i.e. lower response time index (RTI)) than elevator shaft/room sprinkler heads. Fully coordinate all requirements with the sprinkler contractor and provide detectors accordingly (include costs in bid for special heat detectors). Heat detectors may be of the addressable type or may be of the conventional type connected to the fire alarm system through a common addressable interface module (minimum one (1) module for each individual shaft/room opening).

   b) Sprinkler Flow Switches: *Where specifically shown on electrical/fire protection drawings, the following may be utilized in lieu of heat detectors.* Where sprinkler piping is dedicated to serving elevator shafts/machine rooms and where this dedicated sprinkler piping is

provided with code-approved flow/pressure sensing switch(es), utilize switch(es) to activate shut-down function.

5) Any means to bypass or override recall/shut-down functions are part of elevator controls (not the fire alarm system, N.I.C.).

D. HVAC Equipment Shut-Down: Upon any "fire alarm" (or duct smoke detector activation where duct detectors do not activate fire alarm), shut down HVAC equipment (including all air handling equipment operating at 0.94 m^3/s (2,000 cfm) or greater and any other equipment specifically indicated on the drawings or mechanical/ATC specifications) and open/close motorized dampers in accordance with all applicable codes and standards. Provide wiring, conduit, relaying, and final connections from the fire alarm system to ATC controls. Perform all connections at the ATC controls under the supervision of the mechanical/ATC contractor. For equipment operating at 7.08 m^3/s (15,000 cfm) or greater provide at least two (2) detectors per unit (supply and return).

E. Door Release: Upon any "fire alarm", release all magnetic door holders.

4. MATERIALS, EQUIPMENT, AND DEVICES

4.1 CONTROL PANEL MODIFICATIONS: Modify the existing fire alarm control panel to facilitate all new devices specified. Visit the site and verify exact existing control system conditions and requirements in field before submitting bid and include all costs for modifications in bid. No extra consideration, claims, charges, or compensation will be granted under any circumstance associated with fire alarm control panel modifications or resulting from the failure to fully verify all control system conditions and requirements before submitting bid.

A. Existing system components may be reused as much as practical where they support new devices
B. Where necessary to facilitate new signaling devices, provide supervised signal circuit modules (complete and including modules to synchronize all new visual indicating devices)
C. Where necessary to facilitate new output functions (elevator interfaces, HVAC equipment shut-downs, door releases, etc.) provide relaying
D. Modify, upgrade, and/or replace the power supply and control panel main circuitry where necessary to facilitate new devices
E. Modify, upgrade, and/or replace batteries and related components to provide battery backup to operate the system under "normal", "trouble", and "alarm" conditions as per code, but not less than a minimum of 24 hours and then operate the system in "alarm" condition for a minimum of 15 minutes at the end of the 24 hour period.
F. Where necessary to facilitate new initiating devices, provide suitable device termination, zone, and/or loop modules as applicable
G. Where necessary (i.e. due to limitations of existing controls for expansion), provide a slave sub-panel interconnected with the existing control panel.
H. As an alternative to modifying the existing fire alarm control panel, a new fire alarm control panel may be installed to replace the existing control panel (and may re-feed existing peripheral devices), provided there is no additional cost to the project. No

extra consideration, claims, charges, or compensation will be granted under any circumstance associated with the contractor's election to utilize this alternative (include all costs in bid, where this alternative is desired). For this alternative, equipment as manufactured by GE Infrastructure (Edwards/EST), Honeywell (Fire Control Instruments (FCI) and Notifier product lines only), Siemens, and Simplex/Grinnell/Tyco (or approved equal) shall be considered.

I. Where not existing, provide smoke detector(s) located to provide protection/ coverage (in accordance with NFPA-72 requirements) for the main fire alarm control panel, all sub- or slave- control panels, all power supplies, all remote indicating controllers, and related equipment, whether shown on the drawings or not.

J. Provide power to (obtain from power circuit for main control panel) and smoke detector(s) located to provide protection/coverage (in accordance with NFPA-72 requirements) for the main fire alarm control panel, all sub- or slave- control panels, all power supplies, all remote indicating controllers, and related equipment, whether shown on the drawings or not.

4.2 REMOTE ANNUNCIATOR: Modify annunciator to match applicable control panel modifications for annunciation as per code.

4.3 COMBINATION HORN AND STROBE ASSEMBLIES: Provide combination horn and flashing strobe audible and visual notification appliances with code approved wording "FIRE". Provide listed, flush mounted (mount on flush outlet box), ADA approved type wired using Class "B" supervised circuits. Provide listed for wall or ceiling mounting as applicable. Only appliance types featuring both listed wall mounting models and listed ceiling mounting models or models listed for both wall and ceiling mounting shall be considered. For all dwelling units and for sleeping areas in other occupancies, utilize only NFPA compliant low-frequency (nominal 520 Hz) devices. Provide audibly and visually synchronized (utilizing synchronized type appliances in conjunction with suitable synchronizing control modules in signaling circuits) to prevent photosensitive reactions and ensure distinct audible patterns. Provide with adjustable output settings (90, 95, and 99 dBA audible and 15, 30, 75, and 95 or 110 cd visual). Base pricing and wiring and power supply sizing on maximum settings. Lower output settings shall be considered only where they provide audible and visual coverage meeting or exceeding ADA and code requirements (throughout all areas of the project where coverage is required or otherwise shown on the drawings) and where the manufacturer submits calculations/criteria showing compliant coverage. Include costs in bid to provide additional signaling appliances where necessary to provide compliant coverage.

4.4 STROBE ONLY ASSEMBLIES: Provide flashing strobe visual notification appliances with code approved wording "FIRE". Provide listed, flush mounted (mount on flush outlet box), ADA approved type wired using Class "B" supervised circuits. Provide visually synchronized (utilizing synchronized type appliances in conjunction with suitable synchronizing control modules in signaling circuits) to prevent photosensitive reactions. Provide with adjustable output settings (15, 30, 75, and 95 or 110 cd). Base pricing and wiring and power supply sizing on maximum settings. Lower output settings shall be considered only where they provide audible and visual coverage meeting or exceeding ADA and code requirements (throughout all areas of the project where coverage is required or otherwise shown on the drawings) and where the manufacturer submits calculations/criteria showing compliant coverage. Include costs in bid to provide additional signaling appliances where necessary to provide compliant coverage.

4.5 MANUAL PULL STATIONS: Provide station semi-flush mounted (mount on flush outlet box), of the non-coded double-action type with key reset switch. For addressable systems, provide including suitable addressable monitor module.

4.6 SMOKE DETECTORS: Provide detector of the dual chamber, solid-state photoelectric type arranged for two-wire, non-polarized installation. Provide detector of low profile design, white in color, and with twist-lock base for mounting on standard flush outlet box. For addressable and addressable/analog systems, provide detectors of the addressable and addressable/analog types, respectively.

4.7 HEAT DETECTORS: Provide detector functioning on both fixed temperature (rating as indicated on the drawing, unless otherwise required as noted below) and rate-of-rise principals of operation. Provide arranged for two-wire, non-polarized installation, of low profile design, white color finish, and with twist-lock base for mounting on standard flush outlet box. For areas where ambient temperatures may normally exceed 38 degrees C (100 degrees F), such as unconditioned attic spaces or spaces which are not insulated, utilize detectors with temperature ratings as recommended by the detector manufacturer for the application (detectors rated 80 degrees C (175 degrees F) or greater may utilize fixed temperature sensing only [rate-of-rise sensing is not required for these detectors]). Verify all requirements associated with temperature ratings with manufacturer in detail before purchasing detectors or rough-in (no extra consideration, claims, charges, or compensation will be granted under any circumstance associated with temperature ratings of heat detectors).

4.8 DUCT TYPE SMOKE DETECTORS: Provide suitable duct housing with detector (as indicated above), sampling tubes (coordinate with ductwork), supervised fire alarm control relay (to shutdown HVAC equipment), and remote mounted test/reset/indicating station. Provide HVAC shutdown relay either integral to (and part of) duct housing or separately mounted directly adjacent to the duct housing. Where either the HVAC equipment and/or any associated ductwork are new or modified, mechanical contractor shall install detector on ductwork and provide all HVAC shutdown interface wiring from relay to HVAC equipment. Where both the HVAC equipment and all associated ductwork are existing to remain, electrical contractor shall install detector on ductwork (as directed by and under the supervision of the mechanical contractor and mechanical engineer) and provide all HVAC shutdown interface wiring from relay to HVAC equipment (making final connections at HVAC equipment as directed by and under the supervision of the mechanical contractor and mechanical engineer). Electrical contractor shall furnish detector and associated equipment, provide all wiring and connections to fire alarm system, and install the remote test/reset/indicating station in all circumstances.

4.9 FIRE SUPPRESSION SUPERVISORY AND OTHER ACTUATION DEVICES: Interconnect and monitor every fire suppression system (including systems utilizing sprinklers [including fire pump where applicable], carbon dioxide, foam, chemical, halogen, deluge, pre-action, standpipes, etc. where applicable) supervisory device (including flow, pressure, tamper, etc. switches) to the fire alarm system. Interconnect and monitor every fire actuation device part of or installed along with architectural or mechanical equipment and apparatus (including smoke and/or fire dampers [including those in ducts, at shafts, and for ceiling radiation], smoke and/or fire doors, gates, grills, and shutters, fan control, and other similar equipment/apparatus) to the fire alarm system.

Provide all wiring for complete connections between each monitored device and the fire alarm system. Supervisory and actuation devices shall be furnished and installed on fire suppression systems, equipment, and apparatus by the respective installing contractor and wired to the fire alarm system by the electrical contractor. Connect supervisory and actuation devices whether shown on the electrical drawings or not. Review fire protection, mechanical, and architectural drawings and coordinate with fire protection, mechanical, and general contractors before submitting bid and include all costs in bid. For addressable systems, provide including suitable addressable monitor module.

4.10 SUPERVISORY AND CONTROL DEVICES: Interconnect each supervisory and control device (other than fire suppression system devices) specifically indicated on the drawings to the fire alarm system. For addressable systems, provide including suitable addressable monitor module.

4.11 RELAY INTERFACES: Provide a suitable output relays for control relay interconnection to the fire alarm system. Provide all wiring for complete connections to the respective controlled device. Provide output modules for all HVAC/elevator recall and shutdown connections, magnetic door holders, etc..

4.12 Wherever non-addressable ("conventional") style devices remain, are specified, or are otherwise required for the project (i.e. to satisfy code requirements or where addressable devices are not approved by NFPA, UL, or FM for the application) in conjunction with an addressable system, provide each device individually addressed utilizing a suitable addressable monitor module. Verify all requirements before submitting bid and include all costs in bid.

5. LOCKS AND KEYS

5.1 Refer also to the section of this specification "Locks and Keys" of specifications section 16300 "Electrical Materials".

5.2 Provide all fire alarm system equipment enclosures and keyed and/or key operated devices (including pull stations and duct detector test/reset stations) utilizing keys which are alike and which match existing fire alarm system keys.

6. INSTALLATION

6.1 Provide fire alarm wiring in complete accordance with all requirements of other sections of the electrical specifications, except as modified below. Utilize wiring methods in accordance with specifications section 16200 "Electrical Work Practices".

6.2 Provide all fire alarm system wiring as directed, recommended, and approved by the system manufacturer and meeting all system manufacturer minimum requirements (including where manufacturer's requirements exceed the requirements of the specifications and the NEC). #14 AWG conductors are the minimum permitted. Provide all wiring utilizing solid conductors. Stranded conductors are permitted only where in accordance with NEC Article 760. The fire alarm system may utilize individual conductors wiring in conduit and/or multi-conductor cables (in conduit where otherwise required by the specifications).

6.3 Provide multi-conductor cables (where utilized) as follows. Provide insulation rated not less than 300 V. Utilize only cables having an overall red jacket and approved by the NEC and NFPA for use with fire alarm systems. Plenum rated cables may be utilized, but only in dry locations (plenum cables, even when installed in conduit, are prohibited in damp and wet locations). In damp locations, utilize only cables specifically listed and identified for use in damp or wet locations. Provide all cables in wet locations (including underground and embedded in concrete slabs at or below grade) specifically designed for outdoor and submerged use and specifically listed and identified for use in wet locations.

6.4 Provide raceways for the fire alarm system dedicated to fire alarm wiring. Fire alarm raceways may not contain wiring of any other system (including power, lighting, controls, telecommunications, etc.). Where fire alarm wiring is recommended or required by the manufacturer to be separated from other fire alarm wiring due to noise, interference, or other concerns, install wiring in separate raceways (or physically separate wiring as per manufacturer recommendations where wiring is permitted elsewhere to run without raceway). Paint outlet, junction, device, and other boxes, conduit bodies, and covers associated with the fire alarm system red. Paint exposed fire alarm raceways red.

6.5 Identify all new (and existing equipment as specifically indicated below of as specifically indicated on the drawings) fire alarm equipment, devices (as listed below), and wiring as indicated in specifications section "Identification, Nameplates, and Tags" of specifications division 16300, Electrical Materials.

A. Provide an engraved laminated plastic nameplate on the front cover of the existing fire alarm control panel reading, "FIRE ALARM CONTROL PANEL - 120V, 20A - PP1, CCT. 4"). Indicate the exact panel and circuit number feeding the control panel (trace existing circuit in field if required to determine proper circuit). Provide similar nameplates at all power supply units, auxiliary power supplies, and signaling circuit power extender modules.

B. Provide red engraved laminated plastic nameplates with 6.5 mm (1/4") high (minimum) white letters at each new pull station reading "IN CASE OF FIRE: SOUND ALARM AND CALL 911" (or "IN CASE OF FIRE: SOUND ALARM AND CALL THE FIRE DEPARTMENT" where the building telephone system does not facilitate directly dialing 911), "FIRE ALARM DOES NOT CALL FIRE DEPARTMENT", or with other wording as directed by the local authorities having jurisdiction.

C. Provide two (2) engraved laminated plastic nameplates for each new duct type smoke detector, one (1) on the detector housing and one (1) on the remote test/reset/indicating station. List the name and description of the equipment served (i.e. "#AHU-1 - AIR HANDLING UNIT", etc.). Utilize 3.2 mm (1/8") high minimum lettering.

D. For addressable systems, suitably label (in an engineer and owner approved method) all new addressable fire alarm devices (manual pull stations, smoke detectors, heat detectors, duct type smoke detector housings, duct smoke detector test/reset/indicating stations, supervised output relay modules, identification modules, etc.) with the respective system address. Labeling annunciator(s) is not required.

Labeling signaling devices and magnetic door holders is not required, except that labeling is required for any associated addressable relays.

6.6 Where replacing existing fire alarm devices with new devices, existing locations may be used where practical, provided NFPA required coverage is maintained and provided it does not represent a change in scope of work. Where replacing devices in existing drop ceilings which remain, reuse existing ceiling tiles and install new devices in existing holes in tiles (reuse existing holes). Relocate tiles within ceiling for proper device locations. Removing existing devices in such a manner which leaves exposed openings (holes) in tiles is not acceptable. Patching holes in tiles and using blank cover plates to close holes in tiles are not acceptable. Where required to avoid leaving holes, patching, and blank covers, provide (at the electrical contractor's expense) new ceiling tiles to match existing (submit shop drawings [and samples, if requested] of ceiling tiles to the architect and owner for review and approval).

7. QUALITY ASSURANCE

7.1 Completely test the entire system as per "Testing" in specifications section 16100 "General Electrical". Perform the following additional testing.

7.2 Completely test the entire system to demonstrate proper operation, functioning, capability, and compliance with all code and specification requirements. Inspect equipment, devices, relays, signals, etc. for malfunctioning. Correct malfunctions and retest to demonstrate satisfying the above requirements. Perform all testing in complete accordance with all applicable NFPA-72 standards and testing procedures.

7.3 The electrical contractor and manufacturer's representative shall fully certify (in writing) the entire system and system operation, including documenting successful testing of the system. Submit copies of certification to the owner and local authorities having jurisdiction.

7.4 Provide manufacturer's representative services performed by specially trained personnel employed by the fire alarm system manufacturer's representative. Perform manufacturer's representative services (specifically including programming, testing, adjustment, equipment start-up, as-built documentation, and operation and maintenance documentation and instructions) throughout the entire duration of the project, up through final testing and acceptance of the system by the owner and local authorities having jurisdiction, include all costs in bid. *No extra consideration, claims, charges, or compensation will be granted under any circumstance for manufacturer's representative services (including programming, testing, adjustment, equipment start-up, as-built documentation, and operation and maintenance documentation and instructions) during the project (specifically including where associated with changes to the scope of work, alternates, unit prices, allowances, etc.) performed before final testing and acceptance of the system.* Extra claims and/or compensation shall only be considered for changes which are initiated after final testing and acceptance of the system.

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END OF SECTION

SECTION 16550 - SYSTEMS PATHWAYS

1. GENERAL PROVISIONS

1.1 The applicable requirements and conditions of specifications section "General Provisions" of specifications divisions 16100, General Electrical, and 16300, Electrical Materials, are hereby made an integral part of this section.

1.2 This specifications section applies to all pathways and related work for communications systems wiring (including only telecommunications, data, sound, security, and CCTV, where applicable), whether the wiring of each respective system is installed by the electrical contractor, the owner, the owner's vendor(s), or other contractors. The term "wiring installer" applies to the party installing wiring of the respective system. The installer of each system shall be as indicated elsewhere in these specifications and/or the drawings.

1.3 This specifications section does not apply in any way to wiring as part of power, lighting, emergency, over 600 V, control, fire alarm, and any other systems.

2. RACEWAYS AND SLEEVES

2.1 Provide all raceways and sleeves (including all fittings, conduit bodies, boxes, supports, etc.) for communications systems wiring in complete accordance with other sections of this specification except as modified below and unless specifically indicated otherwise.

2.2 Provide minimum sizes for conduits and sleeves as follows, unless indicated otherwise. Provide pull strings in all raceways.

A. 103 mm (4") for main service, trunk line, and primary pathway conduits/sleeves.
B. 21 mm (3/4") for branch secondary pathway conduits.
C. 27 mm (1") for branch secondary sleeves, unless indicated otherwise.

2.3 Install conduits so bends in conduit runs do not exceed a maximum total of 180 degrees between manholes, pull boxes, junctions boxes, conduit bodies, etc..

2.4 Flexible conduit is not permitted for communications systems wiring, unless specifically approved in writing under the following circumstances only. Where flexible conduit is utilized, minimum sizes permitted are 129 mm (5") for main service, trunk line, and primary pathways and 27 mm (1") for branch secondary pathways.

A. Where existing walls are fished.
B. Where physically impossible to install rigid/fixed (non-flexible) conduit.

3. SEALING AND FIRE-STOPPING

3.1 Seal and fire-stop all raceways and sleeves in complete accordance with other sections of this specification and as per code except as modified below and unless specifically indicated otherwise.

3.2 Seal once wiring is installed. Where wiring is not installed at this time, seal all empty conduits.

3.3 Seal all underground conduits and conduits entering the building with suitable rubber conduit plugs as soon as conduits are installed and prior to installation of wiring in conduits. Once wiring is installed, reseal conduits with suitable rubber conduit plugs, water plugs, or duct sealer. Provide all seals water and gas tight.

4. GROUNDING

4.1 Provide all grounding as per other sections of this specification and as per code except as modified below and unless specifically indicated otherwise.

4.2 Provide a ground bus at all communications rooms and backboards. Provide one (1) ground bus assembly for every linear 2.4 m (8'0") of backboard at each respective location. Provide Ilsco #NB-350-42 ground bus assembly with #R16 mounting block (Burndy, Ideal, Thomas and Betts/Blackburn, or approved equal). Bond each ground bus to the building electrical service grounding electrode system with #6 AWG minimum conductors. The ground bus facilitates connecting systems cable surge protectors, where used.

4.3 Provide a #4/0 bare copper ground wire the length of all telephone and data risers, bond to the building grounding electrode system.

4.4 Maintain complete mutual separation between the communications systems grounding system, and the electrical power grounding system, except at a single point of connections to the electrical power grounding electrode system as close a possible to the grounding electrode and/or electrical service.

4.5 Bond all raceways, conduits, cable trays, messengers, etc. to the communications systems ground busses or ground wires.

5. RECEPTACLES/LIGHTING/EQUIPMENT IN COMMUNICATIONS ROOMS

5.1 Locate all equipment to avoid conflicts with risers and cabling. Confirm all exact receptacles, luminaires, smoke detectors, and other equipment locations in writing with the owner prior to rough in.

6. OUTLET BOXES

6.1 Provide minimum depth of outlet boxes as 70 mm (2.75") to facilitate terminating category-5 and similar cables. Smaller boxes are permitted only with written approval and only where construction will not allow use of 70 mm (2.75") deep boxes.

7. WIRING ACCESS PATHWAYS

7.1 Provide complete pathways for communications systems wiring. This includes all raceways, sleeves, cable trays, and other wiring access. Provide pathways as specified below. Provide pathways extending between communications rooms, closets, and

backboards and from these locations to each and every communications systems outlet. Refer to the drawings for additional information.

7.2 Prior to rough in, coordinate all proposed cable routing with the owner and wiring installer.

7.3 Service Pathways: Provide incoming service wiring access pathways as indicated on the drawings, refer to the riser diagram.

7.4 Trunk Pathways: Provide trunk line wiring access pathways between communications closets, rooms, and backboards as indicated on the drawings, refer to the riser diagram.

7.5 Primary Pathways: Provide primary wiring access pathways out from communications closets, rooms, and backboards to serve branch outlets as follows:

A. Provide steel strand supporting messengers along all proposed routes of primary wiring access pathways. This includes all corridors used for telephone, data, and security wiring access. Suitably secure messengers at intervals not exceeding 2.4 m (8'0") utilizing "J" clips or other approved hardware. Messenger installation and routing is not shown on the drawings, provide installation and routing as applicable. Securely support all messenger ends and bends utilizing suitable strain relief clamps. Size messengers as per NEC requirements. Messengers are not required where cable trays and conduits are installed (see below).

B. Provide conduits and cable trays for primary wiring access pathways shown on the drawings.

7.6 Secondary Pathways: Provide secondary wiring access pathways from each individual branch outlet to the nearest primary pathway as follows:

A. Provide conduits from each respective outlet, from communications compartments of surface raceways, and from communications raceways of modular furniture stubbed and capped into corridor drop ceiling spaces (or other primary pathway locations) or into communications closets, as indicated on the drawings, refer to the symbol list.

B. Conduits are permitted to stub into accessible ceiling spaces in other rooms, away from primary pathway locations. Where conduits do not stub directly into corridors or other primary pathway locations, provide sleeves through all walls and obstructions leading from the conduit stub location to the primary pathway location. Provide sleeve sizes based on the quantity of outlets to be wired as follows. Provide multiple sleeves to facilitate the total quantity of outlets.

Sleeve Size	Maximum Quantity of Outlets
27 mm (1")	2
35 mm (1.25")	3
41 mm (1.5")	5
53 mm (2")	9
63 mm (2.5")	13
78 mm (3")	19
91 mm (3.5")	26
103 mm (4")	34

C. The wiring installer shall provide support for secondary pathway cable runs, except that where quantity of outlets served exceeds twelve (12), the electrical contractor shall provide supports as indicated above for primary pathways.

8. WIRING

8.1 The wiring installer (the electrical contractor, the owner, the owner's vendor(s), or other contractors as applicable to each respective system) shall provide only wiring complying with the all of the following.

8.2 Provide wiring for each respective system as directed, recommended, and approved by the respective system manufacturer and meeting all minimum requirements of the system manufacturer (including where manufacturer's requirements exceed the requirements of the specifications and the NEC).

8.3 Provide all cables as multi-conductor style having an overall jacket (of a color other than red; red is reserved for fire alarm) and utilize only cables approved by the NEC for use with the respective system.

8.4 Provide all wiring in plenum spaces in complete accordance with the NEC. In dry location plenum ceilings, utilize only plenum rated cables. For damp and wet location plenum ceilings and in all other duct and plenum spaces, run wiring (utilize a non-plenum type suitable for the damp/wet location) in metal conduit. Plenum rated cables may be utilized for other (i.e. non-plenum) applications, but only in dry locations. Plenum cables, even when installed in conduit, are prohibited in damp and wet locations.

8.5 In damp locations, utilize only cables specifically listed and identified for use in damp or wet locations. Provide all cables in wet locations (including underground and embedded in concrete slabs at or below grade, whether in conduit or direct buried) specifically designed for outdoor and submerged use and specifically listed and identified for use in wet locations.

END OF SECTION